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The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

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A.R.P. for Factories

The Research and Experiments Branch of the Ministry for Home Security has issued from the Forest Products Laboratory, Princes Risborough, Bucks, three bulletins. One deals with the propping of reinforced-concrete beams, and contains full, illustrated instructions for reinforcing the roofs of basements by the construction of extra pillars so that a roof will be sufficiently strong to support the rest of the structure above it should it collapse. The second bulletin, "Damage to Cast-Iron Pipes in Works," suggests that an effective method for protection against earth movements is to provide guard trenches, or to insulate the pipes by the provision of air ducts 12 to 18 in. wide between them and the ground. Where the pipe is not buried at a great depth, guard trenches on either side could be dug to a depth below the pipe. These trenches can be filled with brushwood to prevent erosion without destroying their effectiveness. The greatest care is necessary to ensure that the trenching does not introduce any possibility of the pipe line sinking. Where the pipe runs under a crossing it can be isolated from the surrounding earth by running it through a conduit. It should be a matter of routine to inspect all pipe lines, including deep-laid ones, immediately after an air raid, to ensure that action can be taken without delay when damage has been caused.

The third bulletin, "The Protection of Factory Glazing," makes some important recommendations. For roof glazing it is suggested that external hessian-bitumen treatment holds the glass together sufficiently well after fracturing to afford temporary weather protection. If the glass is additionally supported by wire mesh close underneath or by metal or wood transverse supports at 2 ft. intervals which touch the glass, weather protection is permanent. Again, wired glass is much less likely to fall out of roof glazing when cracked than is unwired glass of the same thickness. It may, however, be bodily dislodged, and therefore requires support beneath by large mesh wire netting or some type of transversal supports.

Whilst wire-netting guards will prevent the flying of glass, it is necessary to preserve the integrity of the black-out and to maintain weather protection. The suggestion is made that works should have on hand a stock of materials for repairing damage to glazing, such as tarpaulins, bituminous and asbestos sheeting.

Finally, it is pointed out that on roofs all types of asbestos-cement sheeting are vulnerable to blast fragments and flying *débris*. The position in regard to vertical surfaces is different, and asbestos-cement sheeting is more resistant to blast than is steel in typical steel factory windows. Copies of these bulletins can be obtained by writing to the Chief Adviser at Princes Risborough.

Colour and Commerce

We recently participated in the first meeting of a consultative committee appointed by the British Colour Council with the object of fostering co-operation between all interior decorating trades interested in colour and the commercial considerations associated therewith. The interests represented were certainly of a diverse character, ranging from carpets to plastics. Our particular interest was to learn just how vitreous enamelling might enter into the scheme of co-operation. As the meeting proceeded we saw for the first time the colour directory established by the Colour Council and endorsed by the British Standards Institution. Here, then, perhaps in modified form, is the basis for co-operation, for we were assured by Mr. G. H. Abbott that all except thirteen of the hundreds of shades included are reproducible by vitreous enamelling. In interior decoration, be it for the hotel or private house, there is an ever-increasing insistence on colour matching schemes and the two sections into which cast iron, through vitreous enamel, enter are the bathrooms and kitchens. It is obvious that to produce the best effect co-operation with the ceramic industry and possibly the paint and distemper manufacturers must be secured. In the kitchen, there is a case for co-operation among the various foundries and sheet-metal works so that colour matching may be attained amongst manufacturers of cookers, ranges, refrigerators, boilers and general domestic hardware, such as mincing machines, coffee grinders, saucepans, kettles and smoothing irons. There is every indication that in the future the kitchen will be more than ever the especial province of the housewife rather than the domestic servant, much as it is in the United States, and efforts will have to be made to make it both artistic and hygienic. The items which go into the furnishing of the kitchen are exceedingly numerous, and the call for co-operation in colour matching will be such that no enterprising vitreous enamelling department will be able to stand aside. Colour to-day is an outstanding feature in selling and, through the enamelling department, the foundry industry possesses a powerful instrument to combat the inroads of plastics and other forms of competition. If this new committee of the British Colour Council can give a useful lead, we see little difficulty ahead of the vitreous enamellers in co-operating, for the colours at their command are indeed all-embracing.

D

Registration of Skilled Engineers

FOUNDRY EMPLOYEES INCLUDED

The Minister of Labour has made an Order requiring the registration of skilled men in specified occupations, mainly engineering. Three categories of men are concerned:—Skilled men in engineering and certain allied industries who are not fully employed on Government work in a test week; men with similar skill employed in engineering maintenance and repair work in other industries; men who, within the last 12 years, have done skilled engineering work for at least 12 months, and have since passed into other occupations.

Men who know they are fully employed on Government work, either directly or on sub-contracts, are not required to register, and if they are in doubt and ask their employers, the employers must tell them whether the work is or is not Government work. The Order excepts undertakings engaged in shipbuilding and ship repairing, iron and steel manufacture or non-ferrous metal manufacture.

The Order is considered to be preliminary to a comb-out of skilled men from the less essential occupations and their engagement in essential production. Registration is compulsory and in the industries where these classes of tradesmen are employed a check on its completeness will be secured by the requirement from employers of lists of the names of men not wholly engaged on Government work and a certificate that all the rest are so engaged. Failure to comply with the Order incurs penalties. The five days of registration, to which also the test of full employment on Government work applies, end to-morrow (Friday).

The Order requires every male person aged 21 and upwards in the named occupations, unless he is wholly engaged on Government work or is employed in an undertaking of an excepted class, to register at an employment exchange or other local office of the Ministry and to give particulars of his place of employment, occupation, type of work, age and experience.

Occupations Named in the Order

The "named occupations" include the following:—

Brass, bronze, aluminium and other non-ferrous metals, finisher, fitter; coppersmith; core maker; die caster; draughtsman (engineering, jig or tool); electrician, including wireman; fitter, assembler, erector, marker-out (engineering and kindred trades, including electrician).

Forgeman, including hammer smith, forge hammerman, forge pressman, hot stamper, hot drop stamper, drop hammer smith, drop forger; gunsmith, inspector, tester, viewer, examiner (engineering and kindred trades, including electrical).

Instrument maker or assembler—all kinds, including scientific; machinist, including driller (boiler, constructional).

Metal annealer, hardener, temperer; metal machinist, including turret lathe operator, capstan lathe operator, miller, borer, grinder, planer, shaper, slotter, driller; millwright, maintenance man (metal); moulder (iron, steel, brass or other non-ferrous metals); power press operator (metal); sheet iron worker, sheet metal worker, including tinsmith.

Toolsmith; toolmaker, press toolmaker, die sinker (cutter), jig or gauge maker; toolsetter (machine or press tools); turner (metal); welder (gas or electric).

SMALL INDUSTRIAL AND DOMESTIC heating appliances in the Reich must in future be made of ceramic materials and replace those hitherto made of cast iron. The manufacture and sale of ceramic heating appliances will be under the supervision of the Reich officials.

Book Reviews

Gauges and Gauging. By R. Barnard Way. Published by Percival Marshall & Company, Limited, 60, Kingsway, London, W.C.2. Price 2s. 2½d. post free.

With the advent of quantity production in the foundry industry, there came into existence a type of practice which reproduced the conditions of the tool-making and machine shops. This resemblance has been growing ever since, and for that reason executives in this type of foundry could with advantage study this small, inexpensive book. They will better understand then the basic principles of gauges and gauging, and such a knowledge will help to attain the close tolerances now imposed upon modern castings.

Engineering Physical Metallurgy. By Robert H. Heyer. Published by Chapman & Hall, Limited, 11, Henrietta Street, London, W.C.2. Price 25s. net.

According to the preface this book is addressed to non-metallurgical students, but it is difficult to realise that that is the author's intention when one reads the book. The first two chapters, headed "Pure Metals" and "Principles of Alloying" respectively, are not likely to be helpful to non-metallurgical or, in fact, to metallurgical students. Chapters 3, 4, 5 and 6 are devoted to non-ferrous metallurgy and the information conveyed, although in general accurate, is very mixed and the matter presented is somewhat indigestible. That particularly refers to the tables, of which there are 20 in these four chapters.

Chapters 7, 8 and 9 are devoted to iron and carbon steels, heat-treatment of steels and low and medium alloy steels respectively. Here again, whilst the information conveyed is in general accurate, the selection and the presentation of the subject leave much to be desired.

In view of the extent to which castings are used, chapters 11 and 13, dealing with steel castings and cast iron respectively, are particularly inadequate, as in neither is there any information that would help a student to appreciate the characteristics and applications of either steel or iron castings.

Chapter 14 is devoted to high alloy steels and, amongst others, refers to valve steels and heat-resisting steels but there is no information about the phenomenon of creep, in spite of its great practical importance to most engineers.

In view of the fact that the author is employed in the research laboratories of an industrial concern, chapter 15, devoted to tool steels, is particularly disappointing. It does not give a true picture of the relationships of the different types of tool steel to one another and is in many ways misleading. The statement that high-carbon high-chromium steel is a comparatively recent development is incorrect. Such steels were in extensive use more than thirty years ago. It is also incorrect to state that its general characteristics parallel those of high-speed steel. Cemented-carbide tools also have a much wider application than one would gather from the perusal of the short section devoted to them.

The book as a whole suffers from lack of logical arrangement and the references are not well chosen. That particularly applies to the 52 references at the end of the chapter on high alloy steels and the 50 references at the end of the chapter on heat-treatment of steel.

J. FERDINAND KAYSER.

British Standards for Precision Tools

Two further specifications have recently been issued by the British Standards Institution in the series of British Standards for engineers' precision tools. These relate to engineers' steel parallels (B.S. 906) and dial gauges for linear measurements (B.S. 907); copies of them can be obtained from the Institution, 28, Victoria Street, London, S.W.1. (Price 2s. 3d. each, post free.)

Random Shots

This war seems to have brought about not only a complete change in the theories of warfare, but also a re-orientation of ideas in almost every phase of life. In the former sphere the revision has already made itself very evident in a practical way. Other changes are slower, and in the interim period result in some funny situations. For instance, a case on the wireless recently caused laughter even in the midst of tragedy. When a housewife was brought before the microphone to say a word about the air-raid in her neighbourhood the previous day, she related how she had just time to run to her Anderson shelter, "Where," said she, "I felt as safe as houses." The front of that woman's house had been blown in by the blast of a bomb, yet she could laugh at the inappropriateness of a phrase which came to her lips by sheer force of habit. Gradually, perhaps, the phrase will change until the familiar version is "as safe as an Anderson shelter." One can imagine, too, a similar situation, say in the messroom at an air base, in which a squadron leader says of some achievement of a colleague, "I could no more do that than fly!" "I could no more do that than sit still" would seem a more apt version of the phrase, at least in R.A.F. circles.

* * *

Apropos of the re-orientation of ideas, it appears that on the occasion of Mr. C. H. Kain's marriage, the Council of the London Branch of the I.B.F. presented him with a silver cigarette box. It was suggested, too, that it might have been filled with cigars, but that would have meant another subscription list being opened. The time is coming, if it is not here already, when it will be more acceptable to give the cigars or cigarettes as the main gift, and the silver case as an afterthought if funds permit!

* * *

At the same time as the Sheffield cutlery manufacturers have been informed that there is to be no more stainless steel for domestic consumption, the production of a new rust-preventing paint is announced from America. What about it? The women will hate to go back to the old drudgery of bathbricking the knives every Friday, and the modern two-by-four kitchen is too small to hold the knife-cleaning machine of yester-year. It is claimed for the invention that the paint sticks to the metal even when it gets red hot, so there would be no fear of it getting mixed up with the grilled steak, should some enterprising soul decide to make a practical application of the idea.

* * *

The "save to win the war" spirit is spreading to all members of the family, for even the children are becoming bitten by the bug. One youngster thought of a scheme that would make a financier's hair stand on end. During the school holidays she earned pennies by doing the simpler shopping errands. If she had earned 3d. by one Saturday she banked it with her mother, who had to find a farthing a week interest. Then she set to work to earn another 3d. by the following Saturday. Fortunately, however, she has never heard of compound interest!

* * *

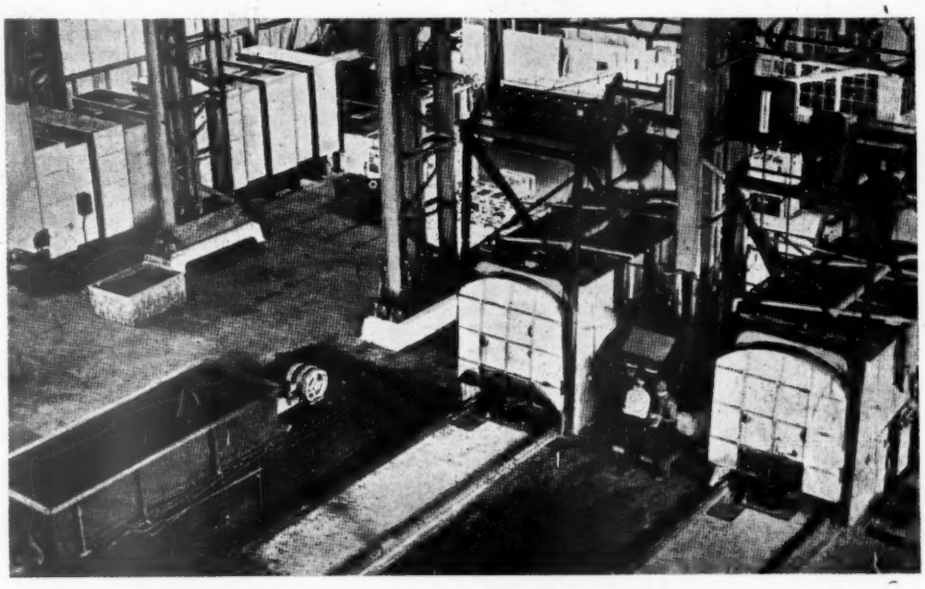
Incidentally, on one of these shopping expeditions, she was asked to buy some flowers, the choice being left to her discretion. She came back with an armful of everlasting flowers, "because," said she, "there were such a lot for 9d., and I thought they might last for the duration."

"MARKSMAN."

Heat-Treatment in Australia

PIONEER PLANT OF COMMONWEALTH STEEL COMPANY

The Commonwealth Steel Company, Limited, Waratah, Newcastle, N.S.W., in which Broken Hill Proprietary, Limited, are interested, manufacture railway tyres, wheels and axles, in addition to springs and other products. In this connection they employ one 6-ton and one 2-ton Heroult electric furnaces. To meet the increasing demand for alloy steels, the company recently added a new section to their heat-treatment department incorporating the latest advances in scientific control. The entire heat-treatment plant is described in a recent issue of the "B.H.P. Review," from which we have made the following extracts.



Section of Heat-Treatment Plant showing the Two Oil-fired and Birlec Electric Heat-Treatment Furnaces.

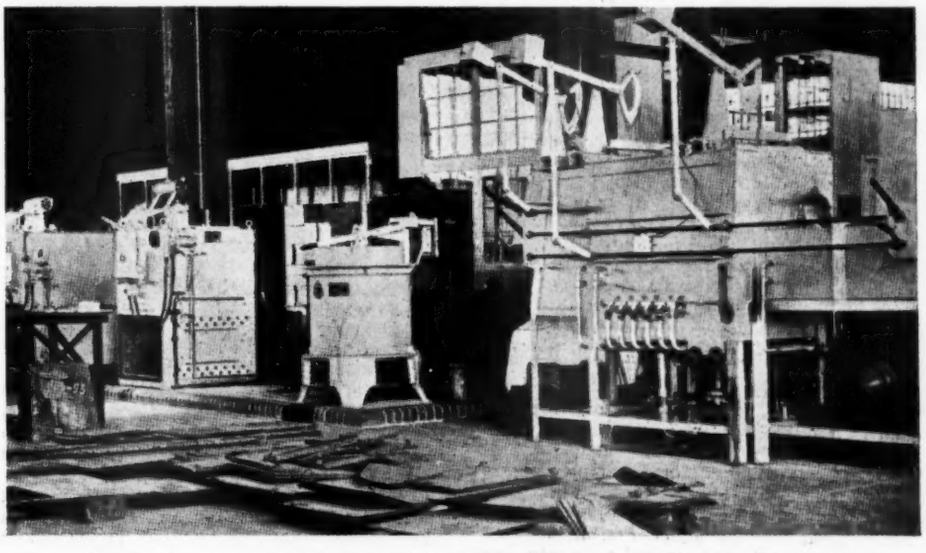
The building comprises the main shop and furnace bay of 81 ft. span and 38 ft. span respectively. Both electric and oil-fired furnaces have been included in the plant, it being realised that each type has its particular application in the production of correctly treated steel. One Birlec furnace of 450-kw. capacity which has been installed, has a hearth measuring 30 ft. by 4 ft., and is capable of accommodating a forging or casting up to 28 ft. long and 3 ft. dia., or charges of smaller products weighing up to 25 tons. This furnace would normally be classified as a "car type," but in this instance the travelling hearth bogie is fitted with roller-bearing axles and driven through a liquid clutch and rack and pinion by an electric motor, thus ensuring rapid withdrawal from the furnace of stock being heat-treated.

Close and effective control of temperature within the furnace is maintained by the division of the furnace into five zones. Each zone is individually controlled by separate regulators supplied by Cambridge Instrument Company, Limited, London; these operate in conjunction with a similar number of thermocouples located at intervals in the furnace roof, and a circuit breaker regulates the heating of each zone to a predetermined temperature. In addition, the history of each charge heated in the furnace—that is, temperature, rate and duration of heating of any particular charge, is accurately and permanently recorded by a four-point Cambridge recording pyrometer, each point of which records the temperature of one of the zones every second. The regulators and pyrometric control switchgear are all accommodated on a central panel, thus centralising control and providing means of simultaneously checking all conditions within the furnace.

Oil-fired, general heat-treatment, "car type" furnaces have also been installed, and these also incorporate electrically driven bogie hearths measuring 15 ft. by 6 ft. Four automatically controlled burners are fitted to each unit, control being again effected by means of Cambridge regulators. The furnaces have a temperature range from 500 deg. to 1,100 deg. C., and can be utilised for normalising, hardening and tempering, and have a capacity of 8 tons per charge.

The quenching tanks are incorporated in a system which interconnects the tank with an "evaporator coil" oil cooler which maintains the temperature of the quenching oil within the required limits, circulation being maintained at a rate of 6,000 galls. per hr., by means of an electrically driven centrifugal pump, thus enabling steel to be quenched from 850 deg. C. at the rate of 6 tons every 3 hrs. Long shafts, which are comparatively small in cross-section, are quenched in a vertical tank which has been sunk into the ground, thus excessive distortion is obviated. A nitriding furnace is included in this shop. It is electrically heated and is capable of dealing with a charge of 30 cwts. or alternatively bars up to 5 ft. in length.

The manufacture of high-speed steels is a new venture being pioneered in Australia by Commonwealth Steel Company, Limited. The equipment comprises three furnaces and subsidiary equipment, including oil- and water-quenching tanks in addition to scientifically designed and controlled air-cooling equipment. The furnaces had been supplied by Birmingham Electric Furnaces, Limited, and they are employed for the three essential processes, namely, preheating, hardening and secondary hardening or tempering. The preheating furnace incorporates the patented "Certain Curtain," which excludes all atmospheric air, preventing oxidation of products. This furnace, which is also fitted with a heat-resisting steel hearth, has a temperature range from 15 to 1,000 deg. C. The primary hardening furnace also has controlled atmosphere, but, due to the higher operating temperature, which ranges from atmospheric to 1,400 deg. C., the hearth is composed of silicon carbide. These units and the secondary hardening furnace are also controlled by means of Cambridge regulators. The temperature range in the case of the last furnace is from atmospheric to 700 deg. C., and to ensure uniform distribution of heat throughout the furnace and uniformity of heating of the products, circulation of the atmosphere within the furnace is maintained by means of a centrifugal fan.



Another Section of the Heat-Treatment Plant showing the Three Electric Furnaces for the Heat-Treatment of High-Speed Tool Steel.

In addition to the electric furnaces mentioned above, we understand that two further furnaces are in course of erection, through the recently established Australian Branch of Birmingham Electric Furnaces, Limited. These are intended primarily for the heat-treatment of small diameter alloy-steel bars, which are hardened at 850 to 900 deg. C., followed by oil quenching, and tempered at 500 to 600 deg. C. They are also suitable for annealing. Both furnaces are of the single-ended batch type, having a

(*Continued on page* 123.)

Metal Sawing in the Foundry

By MARTIN

The majority of patternshops possess at least one band-sawing machine, and therefore the management will be familiar with the design and the necessity of a band saw, not only for straight cutting, but also for sawing sweeps and curves. This type of machine is not only used for sawing wood, but is currently used for sawing such metals as gunmetal, bronzes, aluminium alloys, sheet steel and brass, copper and the like.

Where it is desired to deal with more than one type of metal, the machine can be made to give two or even six speeds to the blade. One speed only is insufficient successfully to saw all metals, and therefore by having a number of speeds from which to select, the most appropriate one is quickly obtainable. Alternatively, if one metal only is involved, then a single-speed machine is all that is required.

The question of saw blades and the length of life obtainable between sharpenings is very important. For soft non-ferrous metals, saws with a temper capable of sharpening with a file give good results, but for harder metals, such as sheet steel, gunmetal, and manganese bronze, a saw should be used with a temper needing emery-wheel sharpening.

The original type of band-sawing machine has undergone many radical changes in order to increase the speed of sawing. Simultaneously, the question of adequate guards over the entire saw blade has received consideration. With the earlier models where much of the saw was exposed, the liability to accident was ever-present. Not only was it dangerous for the operator, but also to anyone passing the machine, especially should the saw break.

Nowadays the whole length of the saw has to be completely guarded with the exception of that portion where the actual cutting takes place. The saw wheels themselves are also guarded by hinged doors, giving the fullest protection against the revolving wheels, with the additional safeguard against saw breakage.

Breakage of Saws

It might be asked why so much attention is paid to saw breakage. Whilst great strides have been made in the quality of steel used for the blades, it is not generally realised that a saw will not run for ever. Many of the saw breakages are due to the continued use when no longer sharp. A really sharp saw having its teeth properly set is essential. It is more economical regularly to change the saw rather than to continue using it until it becomes dull. If the tooth gullet be allowed to become sharp in the corner, it will very quickly result in a crack; thus the gullets must be kept well rounded by the use of a suitable file. In the case of emery-wheel sharpening, the grinding wheel must be shaped with a rounded edge. Maintenance of the saw blades is not a difficult problem. If the machine is not used to any appreciable extent, the teeth can be sharpened by hand, but this method is considered out of date, and therefore it is usual to employ special-duty machines. One method is by file-sharpening performed automatically on a machine, while the same machine will automatically set the teeth. An alternative is found in the use of a grinding wheel where the wheel is shaped to correspond to the shape of tooth. This also is performed automatically.

To repair a broken saw, the ends are filed to a bevel and joined together by an electrical process using a brazing compound. The apparatus is very simple to operate, and an operator can become proficient in brazing saws after a few lessons.

Suitable set of the teeth each side of the blade is essential to give clearance in the cut and also to free the swarf. The amount of set must be equal on each side, otherwise there will be a tendency for the saw to vibrate in the cut and very quickly result in breakage.

To ensure that the teeth are evenly set it is advisable to present to the saw when running at normal speed a grinding stone in order that it will lightly touch the teeth and thereby bring them all into one line. The stone should be used first on the right and then on the left side of the saw.

Tensioning

The tension of the saw over the wheels is very important. The amount of tension given, which is controlled by adjusting a handwheel governing the rise and fall of the top saw wheel, should be such as will permit of the saw being extended ¼ in. from the vertical at a point mid-way between the two saw wheels. To assist the operator and to minimise the danger of giving incorrect tension, certain makers embody a scale and pointer arrangement for indicating the amount of tension suitable for varying widths of saws. The top saw wheel is adjusted until the reading is given by the pointer and the scale corresponding to the width of saw in use. It must be clearly understood that the tension given must change with different widths of saws.

The modern band saw has improved in appearance, this being made possible by the great advances in recent years in the application of electric motors to individual machines as a means of driving. The motor is built in with the bottom saw wheel attached to the motor shaft.

Band saws now run much faster than previously, so as to give a better finish to the work combined with increased output. There is a limit to the speed at which a saw will satisfactorily run, however, and although the quality of steel from which the saw is made is vastly superior to that of a few years ago, if it is run too fast it will very quickly shatter itself to pieces due to vibration and other causes. True, the older types of machines were running far too slow, but there is a happy medium which is practically beneficial and economical. This type of machine can be made with one cutting speed or with three or even six. A three-speed machine driven by an electric motor through a gearbox, the whole being self-contained and compact, is the most popular type. It is evident that this arrangement would be appreciated in any foundry where space is limited, and as the majority of firms are equipped with electric power, full advantage can be taken of installing machinery of the most modern design.

Magnesium-Base Sand-Cast Alloys

The annual meeting of the American Society for Testing Materials at Atlantic City, N.J., had placed before it a proposed revised tentative specification for magnesium-base alloy sand castings. Six alloys (Nos. 2, 3, 4, 11, 14 and 17) of the composition shown in Table I were covered.

The tensile strength requirements of these alloys are set out in Table II.

A further tentative specification covers these alloys and a few others existing in the form of ingots for remelting. Generally speaking, the specification calls for a narrower range in the aluminium content—for example, for alloy No. 2 9.4 to 10.6 per cent. instead of 9.0 to 11.0 per cent. The minimum manganese content is set at 0.03 per cent. higher than the castings specification, whilst the maximum silicon content is lower at 0.2, the copper at 0.04 and the nickel 0.02 per cent. The maximum quantity of other impurities is the same at 0.3 per cent. Finally, the zinc content is controlled at a smaller range than is called for by the castings specification.

TABLE I.—*Chemical Requirements**

Alloy no.	Al. Per cent.	Mn (min.). Per cent.	Zn. Per cent.	Mg. Per cent.	Si (max.). Per cent.
2	9.0–11.0	0.1	0.3 max.	Balance	0.5
3	11.2–12.8	0.1	0.3 „	„	0.5
4	5.3– 6.7	0.15	2.5–3.5	„	0.5
11	—	1.20	—	„	0.3
14	9.0–11.0	0.10	0.5–1.5	„	0.5
17	8.3–9.7	0.10	1.60–2.47	„	0.5

* Additional in every case, the maximum Cu and Ni contents are specified at 0.05 and 0.03 per cent. respectively, whilst the total of other impurities must not exceed 0.3 per cent.

TABLE II.—*Tensile Requirements.*

Alloy no.	Condition.	Tensile strength, min. Tons per sq. in.	Yield strength† (0.2 per cent. offset), min. Tons per sq. in.	E per cent. min. on 2 in.
2 ..	Heat-treated and aged ..	13.0	7.6	*
3 ..	„ „ ..	12.1	7.6	*
4 ..	As cast	10.7	*	4
	Heat-treated	13.4	*	6
	„ and aged ..	14.3	7.2	2
11 ..	As cast	5.3	*	3
14 ..	Heat-treated and aged ..	13.4	8.5	*
17 ..	As cast	8.9	*	*
	Heat-treated	13.4	*	6
	„ and aged ..	14.3	8.1	1

* Not required.

† The yield strength of magnesium alloys is defined as the stress at which the stress-strain curve deviates 0.2 per cent. from the modulus line.

Decomposition of Pearlite in Grey Cast Iron

By A. A. TIMMINS, A.I.C. (British Cast Iron Research Association, Birmingham)

(*Continued from page* 110.)

Sections ½ in. in thickness were cut from each of the as-cast and annealed 1.2 in. dia. bars and used for the following experiments. Two sections, one from the as-cast bar and the other from the corresponding annealed bar, were heated at a definite constant temperature. At the end of a given time the specimens were removed from the furnace and rapidly quenched in cold water. The furnace used was an electrically-heated tube furnace arranged in a vertical position and provided with a platinum/platinum-rhodium thermocouple for recording the temperatures. Two specimens only were heated at one time, these being held by a Nichrome-wire cradle in the centre of the furnace adjacent to the thermocouple hot junction. The specimens were placed in the furnace when it was at the desired temperature, and, judging from the fluctuation in temperature soon after this procedure, the specimens were considered to be completely heated through at the end of 5 to 10 min. Temperature control was maintained to within ± 5 deg. C. At the end of ½ hr., the cradle was dropped into a vat of water placed beneath the furnace. Further specimens were similarly treated after different soaking times, and a series of samples was obtained which had been soaked at various temperatures for varying periods of time up to 8 hrs.

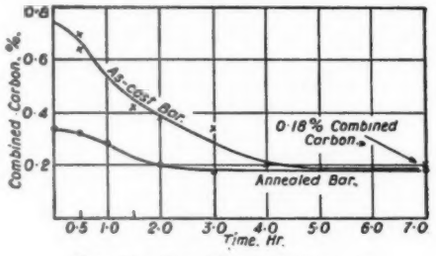


FIG. 11.—BAR NO. 1 HEATED AT 700 DEG. C.

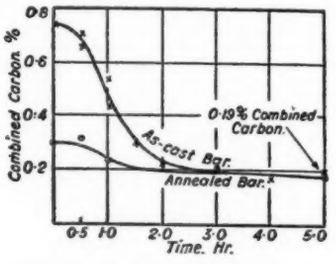


FIG. 12.—BAR NO. 1 HEATED AT 800 DEG. C.

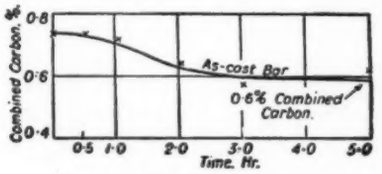


FIG. 13.—BAR NO. 1 HEATED AT 900 DEG. C.

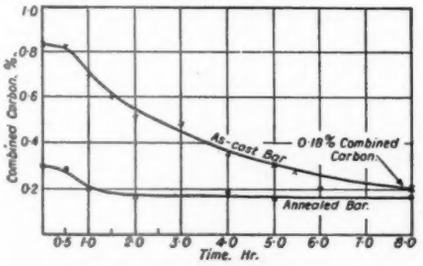


FIG. 14.—BAR NO. 2 HEATED AT 700 DEG. C.

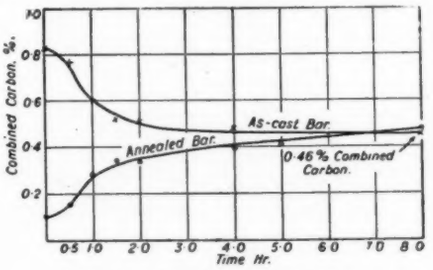


FIG. 15.—BAR NO. 2 HEATED AT 800 DEG. C.

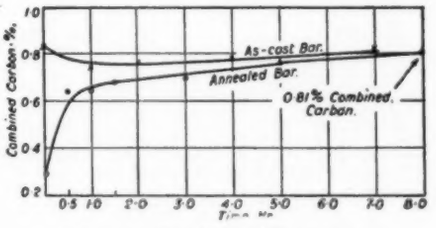


FIG. 16.—BAR NO. 2 HEATED AT 900 DEG. C.

Each specimen was then sampled for analysis and the total-carbon and graphitic-carbon contents were determined. The total carbon was determined by the direct combustion method. The graphite was obtained by dissolving a sample in 1.2 sp. gr. nitric acid and filtering through an asbestos pad. After drying, the normal combustion method was employed, and the combined-carbon content was obtained by difference. Owing to the variety of elements present in cast iron, the Eggertz colour method for combined carbon was not considered reliable. It is also considered unsatisfactory for quenched specimens.

Analytical Discrepancies

In the early stages of the work, considerable difficulty was experienced in the analysis, wide variations in combined carbon occurring between estimations on the same sample and on the same set of drillings. Repeated runs of a standard carbon steel on the combustion furnace gave sufficient assurance that the combustion process was being performed correctly, and it was decided that the discrepancy was due to (1) loss of graphite during the sampling, and (2) incorrect proportioning of graphite and iron when weighing out samples for analysis. Both these factors were aggravated by the relatively high proportion of graphite in some of the samples.

In order to reduce these difficulties, the following procedure was adopted. The specimens were ground all over and then centred in a lathe chuck. After turning off about ⅛ in. from the face, turnings were taken with the aid of a round-nosed Widia-tipped tool, the specimen being rotated at a low speed. By this means the turnings were obtained as "chips," which were collected on glazed paper. A glazed-paper cowl was also used over the tool and specimen to collect any floating graphite, which, however, proved to be very slight. Glazed paper was found to be more satisfactory than ordinary paper, as the graphite did not cling so tenaciously and could be easily brushed off on to the scale-pan on the balance. About 2 to 3 g. of turnings were obtained at one time and the whole of these were used for one estimation, of graphite or total carbon. Several sets of turnings were obtained from the face of each specimen and utilised for analysis.

When large amounts of sample were available, it was often found that fine particles containing a high proportion of graphite segregated in the sample packet and tended to give variable results unless the correct proportion of fine and coarse particles was taken. By using the whole of the turnings for analysis, this was avoided. In addition, the turnings were not ground before being used, so as to reduce any loss of graphite during this operation.

The modifications adopted in sampling reduced the variation in the combined-carbon determinations. The results are shown graphically in Figs. 11 to 17, where the combined-carbon content is plotted against the time of soaking at various temperatures. These curves show the rate of fall and in some cases the increase in combined-carbon content with increasing time of heating. The results obtained at 700 deg. C. on the three irons bear some similarity, the combined-carbon content falling in both the as-cast and the annealed samples to about 0.18 per cent., where it remained fairly constant with further heating. It appeared very difficult to remove this small amount of combined carbon, and examination of the structure showed that small amounts of pearlite seemed to be stabilised by the phosphide eutectic.

At 800 deg. C. rather different results were obtained with the two bars 1 and 2. The 3 per cent. silicon iron No. 1 gave a similar curve to that at 700 deg. C., the combined-carbon content dropping to about 0.18 per cent., though in a shorter time than was required at 700 deg. C. The 2 per cent. silicon iron, on the other hand, showed a drop in the combined-carbon content to about 0.46 per cent. In the corresponding annealed bar there was an increase in the combined carbon until a figure of about 0.50 per cent. was obtained after 8 hrs. heating. This figure thus represents the equilibrium combined-carbon content for the iron No. 2 at a temperature of 800 deg. C., *i.e.*, the solubility of carbon in austenite at 800 deg. C. for a 2 per cent. silicon cast iron.

A strong likeness exists between the curves for the as-cast and the annealed bars, indicating that the rates of decomposition and formation of combined carbon are similar.

The curves showing an increase or decrease in the combined-carbon content with increasing time of soaking bear a further significance when the time is plotted on a square-root scale; Fig. 18 contains some of the results so plotted. From this it will be seen that for a heating temperature of 700 deg. C. there is very little difference in the rate of removal of combined carbon with a change in the silicon content. This appears contrary to the results of Kikuta[4] and also of White and Schneidewind,[3] who showed that the time to complete second-stage graphitisation (*i.e.*, below the critical point) in malleable cast iron decreases logarithmically with the increasing silicon content. The

apparent divergence from the present findings may be explained if, as White and Schneidewind suggest, an increase of silicon in malleable cast iron promotes the formation of more nuclei, leading to an increased rate of graphitisation. In the present instance, the irons were not heated above 700 deg. C., so that no new nuclei could be formed, and, even if they were, their number would be very much outweighed by the preponderance of graphite flakes already present.

Whilst little difference in the graphitisation rate occurs with an increase in silicon content, there is a big increase in the rate of removal

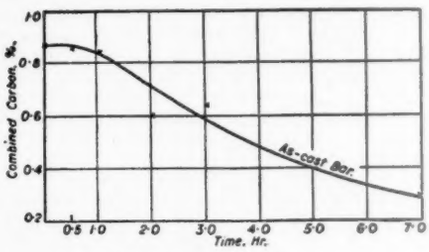


FIG. 17.—BAR NO. 3 HEATED AT 700 DEG. C.

of combined carbon below the critical point on increasing the temperature above 700 deg. C. This is shown by an examination of the graphitisation lines for the 2 per cent. silicon and 3 per cent. silicon irons at 700 deg. C. and also at 770 deg. C. and 800 deg. C. respectively.

It would therefore appear that combined carbon may be removed more or less completely by heating at temperatures below the critical temperature Ac_1, and the nearer the heating temperature is to the critical point of the iron, the more rapid is the removal of the combined carbon. When the heating is conducted above the critical point, combined carbon may or may not be removed according to whether the initial combined-carbon content is above or below the equilibrium content for the temperature of the anneal. Thus, if the combined carbon is high, it will tend to fall to the equilibrium content as heating is prolonged, whilst it will tend to rise to the equilibrium content if it is low in the as-cast bar.

From the data obtained it would appear that the removal of combined carbon in grey cast iron is proportional to the square-root of the time of heating, which confirms the suggestion made by Schwartz and others that graphitisation is a diffusion phenomenon and follows similar laws to those governing the diffusion of solids in liquids. Additional evidence is found in the increase in the rate of graphitisation which is produced by raising the temperature of heating (while still keeping below the critical point), if it is assumed that the mobility of the carbon atoms is increased by a rise of temperature. On this argument, the similarity of the rates of graphitisation of the three irons at 700 deg. C. would seem to show that silicon has little effect on the diffusion rate of carbon in iron.

Microstructure

The structures of the samples heated at temperatures below the critical point appeared the most interesting. The heating period at 700 deg. C. caused the pearlite to coalesce, and in the earlier stages of the anneal, *i.e.*, after ½ and 2 hrs., the carbide of the pearlite could be seen to be diminishing in amount near the graphite clusters, whilst a preponderance of carbide occurred near the phosphide eutectic. This change is shown in the photomicrographs (see Figs. 19 to 23) taken of the bar No. 2 heated at 700 deg. C. The close laminations of pearlite near the phosphide eutectic can be seen becoming more open in texture and eventually disappearing as the graphite flakes are approached. Fig. 23, taken at 1,200 diameters, illustrates the structure of a graphite flake in the sample heated at 700 deg. C. for 4 hrs. The deposition of graphite on the existing flake can be seen clearly, showing that the carbide of the pearlite has migrated to the flake and then broken down. The deposited graphite gives a serrated appearance to the graphite flakes, when examined at high magnifications.

TABLE II.—*Variation of Solubility of Carbon in Austenite with Varying Silicon Content (Charpy and Cornu-Thenard).*

Silicon. Per cent.	Carbon, per cent., in solution at—				
	600 deg. C.	700 deg. C.	800 deg. C.	900 deg. C.	1,000 deg. C.
2.23	0.0	0.0	0.6	0.8	1.1
3.16	0.0	0.0	0.0	0.7	0.9
4.22	0.0	0.0	0.0	0.2	0.7
5.84	0.0	0.0	0.0	0.0	0.3
6.77	0.0	0.0	0.0	0.0	0.2

Solubility of Carbon in Austenite

Some attention has been paid in the past to the question of the solubility of carbon in austenite under equilibrium conditions. Charpy and Cornu-Thenard[3] studied the influence of silicon on the solubility of carbon for carbon contents of 2 per cent. and a range of silicon of 2.23 to 6.77 per cent. These workers commenced by annealing their irons to remove all the pearlite, after which samples were heated at constant temperature for 1 to 3 hrs., being then quenched in water. The results obtained by those investigators are given in Table II.

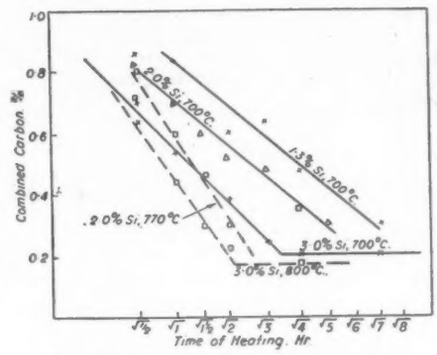


FIG. 18.—RELATIONSHIP BETWEEN THE COMBINED-CARBON CONTENT AND THE TIME OF HEATING.

Becker[4] has also studied the solubility of carbon in austenite for silicon contents up to 4 per cent., using cementation experiments. The results given by this worker relate only to slowly-cooled specimens and may not therefore be said to give an exact record of the maximum solubility of carbon in γ-iron at any particular temperature.

White and Schneidewind have also given an equilibrium diagram for iron-carbon-silicon alloys showing the effect of silicon on the solubility of carbon in austenite.

In order to throw light on this question, a number of ¼-in. sections from the bars 1, 2 and 3 were heated for periods of 10 hrs. at various temperatures. An electric furnace fitted with automatic temperature control was employed for this purpose. In view of the results obtained in the previous experiments, it was considered that the specimens would have at-

FIG. 19.—BAR NO. 2 HEATED ½ HR. AT 700 DEG. C. QUENCHED. × 300.

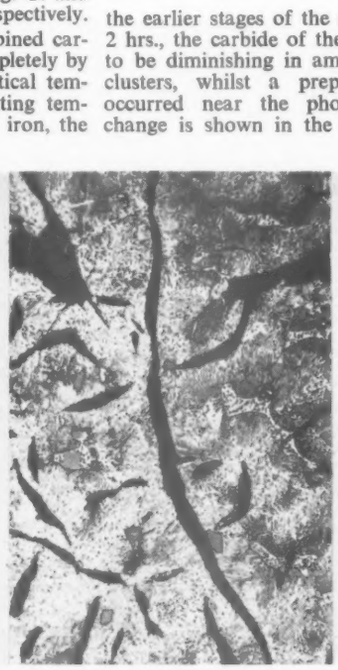


FIG. 20.—BAR NO. 2 HEATED 1 HR. AT 700 DEG. C. QUENCHED. × 300.

FIG. 21.—BAR NO. 2 HEATED 3 HRS. AT 700 DEG. C. QUENCHED. × 300.

FIG. 22.—BAR NO. 2 HEATED 6 HRS. AT 700 DEG. C. QUENCHED. × 300.

tained equilibrium at the end of the 10-hr. period. After this time, the samples were rapidly quenched in water. Samples were taken for analysis in the manner previously indicated, care being taken to discard about ¼ in. from the face of the specimens to avoid any decarburisation. The results of the combined-carbon determinations are given in Table III.

These results, together with those values derived from the previous experiments, are plotted in Fig. 24, and though no extreme accuracy can be claimed, they give some indication of the effect of silicon on the solubility of carbon for the three irons for temperatures up to 900 deg. C.

TABLE III.—*Solubility of Carbon (per cent.) in Austenite.*

Heating temp. Deg. C.	1.3 per cent. silicon iron.			2.2 per cent. silicon iron.			3.2 per cent. silicon iron.		
	T.C.	G.C.	C.C.	T.C.	G.C.	C.C.	T.C.	G.C.	C.C.
750	3.40	3.20	0.20	3.45	3.25	0.20	3.30	3.18	0.12
	—	—	—	3.46	3.36	0.10	3.29	3.24	0.05
	—	—	—	3.42	3.37	0.05	3.31	3.11	0.20
775	3.42	2.84	0.58	—	—	—	—	—	—
	3.40	2.72	0.68	—	—	—	—	—	—
850	3.39	2.51	0.88	3.42	2.72	0.70	3.32	2.88	0.44
875	3.38	2.50	0.88	3.45	2.79	0.66	3.32	2.76	0.56
900	3.41	2.34	1.07	3.43	2.67	0.76	3.30	2.67	0.63
	3.40	2.36	1.04	3.40	2.66	0.74	3.33	2.74	0.59
	3.39	2.44	0.95	3.45	2.63	0.82	3.31	2.70	0.61

Summary

It has been shown that the annealing of grey cast iron involving the decomposition of pearlite may be readily accomplished at temperatures below the critical point, and that in such cases the rate of cooling after heating is of little importance. Annealing may be carried out at temperatures above the critical point, but when heating at constant temperature, pearlite will not be removed unless the initial combined-carbon content is above that denoted by the equilibrium for the particular temperature and composition of iron used. The major factor in the removal of pearlite by a high-temperature anneal is the rate of cooling after the anneal, the slower the rate of cooling the greater being the amount of pearlite which is removed.

Confirmation is given which shows that the removal of pearlite in cast iron at constant temperature is a diffusion phenomenon. The rate of graphitisation at temperatures below the critical point is increased by an increase in temperature, and the most successful method of removing pearlite in grey cast iron is to heat at a temperature as near to the critical temperature Ac_1 as possible. Silicon does not appear to affect the rate of graphitisation at constant temperature. However, the facility with which high-silicon irons anneal may be accounted for by the fact that the as-cast combined-carbon content is usually lower than for lower-silicon cast irons. The critical point is raised and the solubility of carbon decreased by an increase of silicon, which means that for a given temperature more pearlite may be removed than with an iron of lower silicon content.

Since the decomposition of pearlite becomes more rapid as the heating temperature is raised, the best method, particularly for high initial combined-carbon contents, will be to start the anneal at some temperature above the critical point, and to reduce the temperature at some predetermined rate to a final temperature of annealing in the region of the critical point. After this treatment the castings may be cooled as quickly as possible consistent with other factors such as the possibility of warping or cracking. Data are given for the solubility of carbon in iron for temperatures up to 900 deg. C. for three different silicon contents.

The results obtained have a great bearing on the commercial annealing of grey cast iron, the most important feature being that softening can be obtained most easily and more completely by annealing at temperatures near the critical point of the iron concerned. If higher temperatures are employed, very slow cooling is necessary in order to remove all the pearlite and obtain maximum softness.

In most cases, the softening of cast iron for the production of easily-machinable iron is carried out in a haphazard manner and usually at temperatures above the critical point. Needless time and money are spent on long soaking periods at these temperatures, and, more often than not, the subsequent rate of cooling is too fast to accomplish the desired softening. The use of a soaking temperature near the critical point of the iron enables the annealing operation to be carried out more economically and removes the necessity for the slow-cooling period.

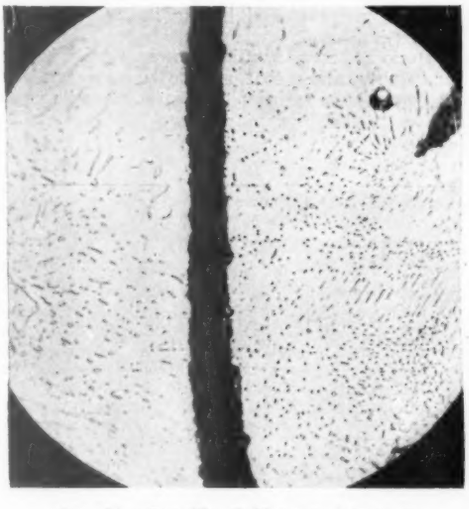


FIG. 23.—BAR NO. 2 HEATED 4 HRS. AT 700 DEG. C. QUENCHED. × 1,200.

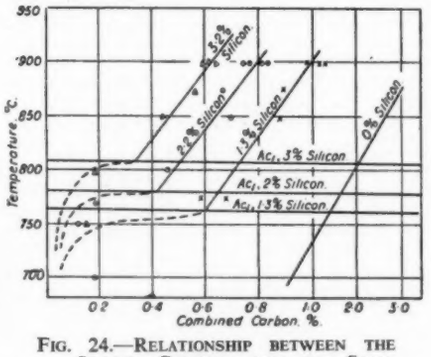


FIG. 24.—RELATIONSHIP BETWEEN THE SILICON CONTENT AND THE SOLUBILITY OF CARBON IN IRON.

This research also has a bearing on the annealing of cast iron in the enamelling industry. An annealing treatment is often carried out on such iron in order to remove dirt and occluded gases, and the temperature required involves the decomposition of the combined carbon; unless the whole of the combined carbon is removed, it is often found that the resultant castings are warped.

Cases have been met with, particularly in continuous annealing plants, where a high-temperature anneal with a too-rapid cooling stage has been employed. The pearlite in the resulting castings was only partially removed, and considerable warping occurred when the castings were enamelled. A change in the heating temperature to 800 deg. C. (2.8 per cent. silicon iron) resulted in the whole of the pearlite being removed. The warping during enamelling on such castings was thereby reduced considerably.

The author wishes to express his thanks to the Council of the Iron and Steel Institute for the award of a grant from the Andrew Carnegie Fund, with the aid of which this research was undertaken; his thanks are also due to the Director, Mr. J. G. Pearce, and the Council of the British Cast Iron Research Association, in whose laboratories the work was carried out.

REFERENCES.

[5] Charpy and Cornu-Thenard: Journal of the Iron and Steel Institute, 1915, No. I, p. 276.
[6] Becker: Journal of the Iron and Steel Institute, 1925, No. II, p. 239.

Catalogues Received

Electric Combustion Furnace.—A leaflet received from the Harry W. Dietert Company, of 9,330, Roselawn, Detroit, Mich., illustrates and describes the No. 3,400 Varitemp combustion furnace, which has a temperature range up to 1,500 deg. C. This muffle has the transformer, pyrometer, voltage control and power switches built in to form an integral unit which is housed to resemble a modern radio set. The muffle uses three Globar heating elements, which are equally spaced around the combustion tube, creating a uniform high-temperature zone therein 6 in. in length. The voltage selection is quite novel, and is effected by the turning of two rotary switches at the front of the casing and can be controlled to within two volts.

Foundry Specialities. F. & M. Supplies, Limited, 21-23, Coldharbour, London, E.14, have sent us half a dozen leaflets covering a number of interesting phases of foundry practice. Included amongst these are a preparation for removing aluminium existing as an impurity in heavy non-ferrous scrap; a compound for degasifying and generally refining cuprous alloys having a melting point higher than 850 deg. C.; and a material for making patterns of the "stone" type. Another leaflet describes the potentialities and use of a sand revivifier. This material, "Remed," discloses what is to us a novel practice. Finally, an iron cement and a core gum are covered in separate leaflets.

Heat-Treatment in Australia

(*Continued from page* 119.)

grooved hearth to accommodate the arms of a charging machine which has been built to Birlec design in Australia by the Commonwealth Steel Company. Each furnace is rated at 225 kw. and the internal dimensions are: Length 18 ft. 3 in., width 3 ft. 9 in., and height 1 ft. 5 in. To minimise scaling and decarburisation, the furnaces are arranged to work with an artificial atmosphere supplied by a charcoal gas plant which has also been constructed in Australia to Birlec designs.

The furnace heating elements are in three separate zones, regulation being by Leeds & Northrup potentiometric indicating and recording controllers.

Synthetic Moulding Sand*

By F. PASCHKE

The importance of employing a moulding sand which, by virtue of its constitution, satisfies all requirements cannot be over-emphasised. It is not sufficient to prepare from one or more sands a "moulding sand" which is merely assumed to be suitable for casting purposes. Experience shows that a large percentage of rejected castings is due to unsuitable moulding sand. A good moulding sand will minimise considerably the consequences of carelessness, intentional or otherwise, on the part of the moulder, which form the cause of a considerable proportion of the remaining percentage of rejected castings.

A knowledge of the requirements which a good moulding sand has to satisfy and the way in which these requirements may be met by sand of suitable composition leads to an economic use of sand, obviating the transport of unserviceable old sand and of corresponding quantities of new sand. The principal properties which a good foundry sand should possess are refractoriness, permeability (venting quality) and strength. Refractoriness is provided by a high quartz content, permeability is ensured when the grains are uniform in size and are rounded in shape, when the binder envelops the individual grains, and when the sand shows the least tendency to dust formation. The strength depends upon the nature and quality of the binder, but if increased excessively will result in diminished permeability.

Where natural sand possessing the desired properties is not readily available, a saving in transport costs may be effected by the use of what are termed "synthetic sands," although this expression is not altogether a very happy one, because it sometimes gives the impression that the sand contains a synthetic or artificial binder. This is misleading, and it would be more in keeping with the general opinion to define a synthetic moulding sand as one consisting of a mixture of various kinds of sand and a binder, in contrast with a moulding sand which can be used without any admixture.

Synthetic moulding sands are considered to have particular advantages over any natural sand, and are expected to satisfy the following requirements:—

(1) They should possess all the usual moulding properties, such as compressive strength, shear strength, permeability and refractoriness, while in addition they are considered to be more homogeneous than natural sand.

(2) As far as possible, the used sand should be entirely reserviceable, and it should be possible to restore to it the original good properties to the greatest possible extent.

(3) Transport and preparation should cost less and should be much more convenient than in the case of natural sand.

(4) Above all, however, synthetic moulding sand should always be of constant quality and should never require any variation in its mode of preparation. It should be unaffected by varying treatment at the hands of the moulder, and, in the case of dry-sand casting, should ensure rapid and thorough drying.

Fundamentally, synthetic moulding sand is composed of quartz sand, which does not possess any binding properties, and clay, which acts as a binder and imparts plasticity and strength.

Many mixtures of quartz sand and suitable clays produce very good moulding sand possessing excellent properties, but large proportions of clay (10 to 50 per cent.) are necessary to ensure the desired plasticity. Clays, or sands having a high clay content, are not all equally good binders, and in cases where it is desired not to use excessive additions of clay, resulting in excessive packing of the moulding sand, it is possible to ensure high strength and excellent moulding properties by adding organic binders, such as train oil tailings, sulphite liquor, starch, etc. Many foundries have in this way achieved excellent uniformity in their moulding sand, particularly the facing sand, so that there was no reason to confuse these long-tried synthetic moulding sands with other synthetic sands or with natural sand.

A recent innovation is the "Geko" process, which is particularly suitable for the production of synthetic moulding sand. The "Geko" process imparts maximum plasticity, strength and permeability to sand which is absolutely without binder.

What is "Geko"?

It is a purely inorganic preparation and has nothing in common with the ordinary commercial moulding-sand and core-sand binders. Its outstanding property, which is not even approximately approached by any "binder," *is that of forming gels which are capable of swelling.* By the term "gel" is understood a colloidal formation, hence the expression "Geko" from the words gel and colloidal. As already stated, "Geko" is not an organic binder, such as sulphite liquor, dextrin and other starch products, or binders containing oil or pitch, but is an inorganic binder with high swelling properties, and therefore, even after pouring the moulds, it does not contaminate the sand or produce dust through the formation of ash or coke, as is unavoidable in the case of organic binders.

An addition of only 1 per cent. of the material to synthetic moulding sand of pure quartz and a small proportion of clay results in a moulding material of first-rate quality and absolute uniformity.

It must be appreciated that the particle size distribution of a uniform sand should be maintained constant. This is effected in iron foundries by always adding a certain proportion of quartz sand to the facing sand, but where nowadays oil-bonded cores of pure quartz sand are employed, the formation of dust in a moulding sand is counteracted automatically, since when the moulds are knocked out, the burnt-out core sand passes into the moulding sand or is intentionally added to it. For many purposes, however, an excessive addition of this used core sand results in an undesirable increase in the coarseness of the grain, and each foundry has to ascertain by trial the necessary amount of coarse core sand, which may fluctuate between 10 and 40 per cent., according to the original foundry sand and the type of castings to be produced.

The figures in Table I below are given by way of illustration.

TABLE I.—*The following daily quantities of used core quartz sand or fresh quartz sand (sea sand, river sand, moor sand or building sand) have been found necessary or adequate for maintaining an approximately uniform particle size.*

Type of castings.	Quantity of used or fresh quartz core sand added daily.
Heavy engineering castings	20 to 40 per cent.
Motor-car castings	15 to 30 per cent.
Radiators, sanitary castings and stove castings	10 to 20 per cent.

The above indicated restoration of the particle size does not alone convert old sand into moulding sand ready for further use. There must be, in addition, a restoration of the plastic properties, this being customarily achieved by the addition of a natural sand having a high binder content.

A very large proportion of new sand would, however, be necessary in order to impart plasticity to the above-mentioned mixture of old sand and core sand. An addition of "Geko" renders this addition of natural sand entirely or partly unnecessary. The ability to impart plastic properties to moulding sand which has little or no plasticity is a consequence of the high swelling properties of the material, which replaces natural sand having its own bonding properties.

It possesses a swelling power which is ten or twenty times that of the natural swelling clay to which the moulding sand owes its plas-

(*Continued on page* 128.)

TABLE II.—*Effect of 1 per cent. "Geko" on Used Sand.*

Properties on which suitability for moulding depends.	Old sand which has become unserviceable.	The same sand after addition of 1 per cent. of "Geko."
Permeability	14.2	21.6
Compressive strength, grms. per sq. cm.	337	940
Shear strength, grms. per sq. cm. ..	103	220
Moisture content, per cent.	8.38	8.38
Behaviour during moulding and pouring.	Convex parts of the mould continually fell off despite use of gaggers, and had to be repaired. The casting had scabs and defects due to washing away of sand.	Sand possessed excellent moulding properties. All convex parts of the mould were drawn clean, despite considerable omission of gaggers. The casting had a flawless surface.

TABLE III.—*Effect of 1 per cent. "Geko" in Facing Sand.*

Properties as determined.	Mixture of 30 per cent. natural moulding sand and 70 per cent old sand.	
	Without "Geko"	With 1 per cent. of "Geko."
Permeability	22.5	31.0
Compressive strength, grms. per sq. cm.	510	1,020
Shear strength, grms. per sq. cm. ..	131	250
Moisture content, per cent.	6.2	6.2
Behaviour during moulding and pouring.	Good, but in places numerous gaggers necessary for convex mould parts.	Much better than sand without "Geko." Even complicated convex parts are drawn smoothly without gaggers. Surface of castings exceptionally smooth and clean.

* Translated from "Giesserei-Praxis"

Application of External Chills in the Production of Steel Castings*

By W. F. McKEE

External or Internal Chills?

External chills have some advantages over internal chills. Some of these advantages are:—(1) Exact size is not so important; they do not have to fuse into and become a part of the casting metal as must an internal chill. (2) They can almost always be used more than once; in many cases they can be used repeatedly. (3) Cleanliness is not of primary importance, as all gases evolved will be at the metal surface and have easy escape through the sand of the mould wall. (4) So far as the author knows, no user of castings objects to their use, except on sections from which test-bars are to be taken; many users do object to the use of internal chills.

External chills have the disadvantage that they nearly always have to be cast, machined or burned to fit the section they are to chill. Size also must receive some consideration, for they must be of sufficient size and suitable shape to chill the intended section, yet not so large or of such shape as to choke off necessary feed, thus causing not only shrinks but cracks. The actual design, in detail, and location of external chills, are of prime importance, as will be shown later, and must be correlated with heading and gating practice to control results.

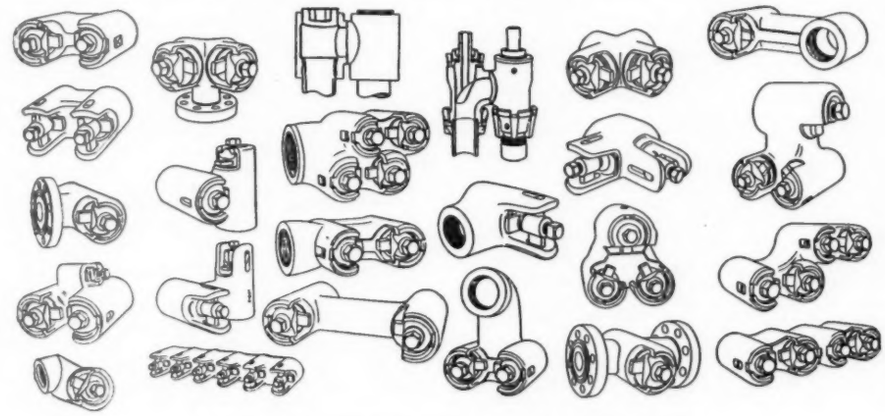


FIG. 1.—VARIATIONS IN DESIGN OF REFINERY FITTINGS.

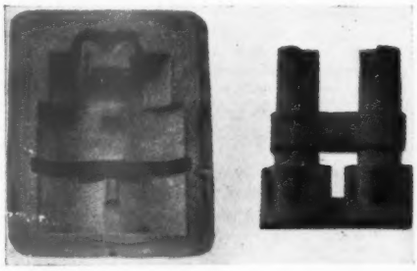


FIG. 3.—CORE AND DRAG MOULD FOR REFINERY FITTING, WITH CHILLS IN PLACE.

A Specific Application

Perhaps discussion of such a well-known subject as external chills may be fostered by taking some specific application. The foundry with which the author is connected in a speciality shop. Almost all the work is composed of high-pressure carbon and alloy steel castings for the oil industry. They are made under strict specifications and subject to rigid inspection. One of the specifications is that no internal chills may be used in castings, and that no external chills may be used on sections where test-bars are to be taken.

Fig. 1 shows a few of the many designs of castings used in the oil industry. Although there are innumerable designs, they all have section relations that are quite similar and are more clearly illustrated in Fig. 2.

Section Size.—As-cast, the casting has from ⅛ to ½ in. more metal for machine-finish in tube holes and plug seats, as is shown in Fig. 2. It is readily seen that there is a great difference in section between these seats and the body metal of the casting. This is true especially in crotches between openings in all the many designs, and presents a real problem in proper solidification.

Influencing Directional Solidification.—The practice in this foundry is to try to influence directional solidification wherever possible. The head and gate are attached to the tube end of the casting. The head sets off the face of the casting adjacent to the heavy crotch between openings; the gate feeds directly into the head, so that gate and head are removed with one torch cut. The plug seats are chilled with external chills placed in the mould wall.

Reasons for Use of Chills on Plug Seats.—It has been found more economical to use chills on plug seats (1) because of the close nesting tolerances of the castings it is expensive to remove heads to such close limits; (2) because the design of casting is such that to head the casting would mean placing the head in the crotch between the ears, and the removal of the head would be very difficult; and (3) because much of the work is renewals and the chills save much metal that otherwise would be used in heads.

Most of these castings are such that plug seats may be made solid with external chills rammed up in mould walls; but an occasional design will have such a heavy section in the crotch that one has to resort to a small chill in the core in addition to usual chills in mould.

Procedure in Making a Casting

Figs. 3 and 4 show the drag and core for such a casting. The chills were painted black so they would be more easily distinguished against the lighter background of core and mould. Normally, the chills in either core or mould get the same spray-wash treatment as the core or mould. They are washed with a silica-base mould wash. The cores are dried in a vertical type continuous recirculating oven for 2¾ hrs. at 260 deg. C. The moulds are dried in a horizontal-type, continuous, recirculating oven for 1½ hrs. at 315 deg. C. The cope for the drag shown in Fig. 3 would have a like number of chills, thereby making a complete band of chills around the heavier plug-seat section of the casting.

The chills in each section of the mould are composed of three sections, two band chills and one crotch chill. The section of the chills is determined by an empirical rule developed through experience with this particular class of work. All new designs are determined by the hit-and-miss method and checked by pilot castings.

Fig. 4 shows the core set in place in the drag mould. It will be observed that the chills do not cover the edge of the seat next to the head and gate. This is purposely left open for feeding, otherwise it would be difficult to get a solid plug seat.

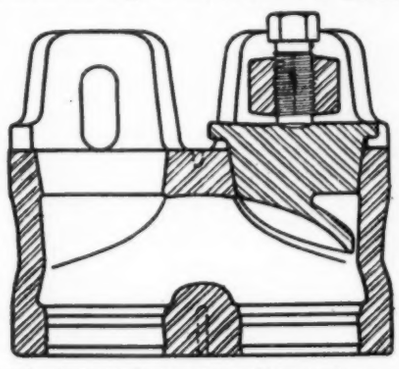


FIG. 2.—SECTION RELATIONS OF TYPICAL REFINERY FITTING.

Core chills are avoided whenever possible for several reasons:—(1) They are more likely to cause defects than outside chills, because any gas generated does not have as free exit without passing through metal. (2) A greater number is required on long-run jobs due to the fact that cores must be made well ahead of casting time, while the mould is made only a few hours, and never more than one day, before being cast. (3) They are more trouble to keep in production, for they often stay in castings until after heat-treatment. (4) Due to excess heat and the fact that they often undergo heat-treatment, they deteriorate more rapidly, and therefore have to be replaced more often than outside chills.

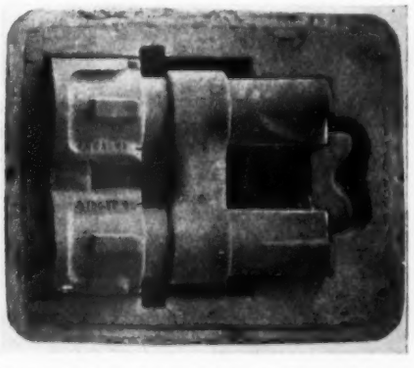


FIG. 4.—CORE SET IN PLACE IN DRAG MOULD.

The foundry in question, however, uses core chills extensively in the manufacture of flanged fittings. Fig. 5 illustrates this application.

* Abstract of a Paper read before the American Foundrymen's Association. The author is general foundry foreman, the Key Company, East St. Louis, Ill.

These chills are used only in the drag half of the core, and cover approximately 120 deg. of the inner circle of the flange. The chills must be kept back from the face of the flange, otherwise in casting they may cause small cracks at the edge of the chill.

CHILL DESIGN AND POSITION OF CHILLS ON SECTION JUNCTIONS

Some excellent work on design and chilling of section junctions was carried out by Briggs, Gezelius and Donaldson and their results were presented before the American Foundrymen's Association.* As these investigators were interested primarily in casting design, the author was not satisfied with their chill treatment of sections. Since the foundryman is seldom consulted as to the design of castings, a study was instituted to see what results might be accomplished in section junctions with cast chills designed for specific application. Much of the work done in this study follows closely the ideas suggested by a study of the work done by Briggs and his co-workers. Although this present study is far from complete, it is believed the results and information so far obtained may be of interest to some if presented at this time.

Five Ways of Joining Sections.—There are only five ways in which sections may be joined. These are designated by the letters of the alphabet which a plan view of sections shows they most closely resemble, namely: L, T, V, Y and X. There are many modifications of these

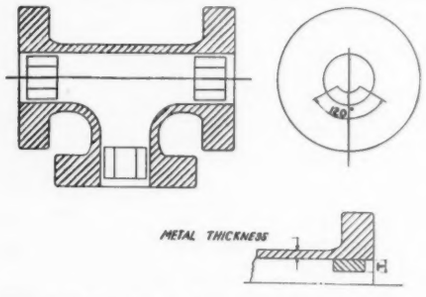


FIG. 5.—METHOD OF APPLYING CORE CHILLS TO FLANGED FITTING.

designs, each of which presents a different problem of solidification.

Patterns Used.—The patterns used were of 3-in. by 3-in. cross-section. The arms were 18 in. long, with heads attached at extreme ends. Moulding was by the green-sand method, and chills were uncoated. All castings were poured in the horizontal position through feed heads. Plain carbon, acid-electric steel was used. The steel was poured from a bottom-pouring ladle, with the metal taken from near the middle of a 4-ton heat. To avoid erroneous results, produced by the effects of directional solidification and temperature gradients, all castings of a series were poured consecutively in the same heat and through corresponding feed heads.

Reasons for Use of 3-in. Sections.—Castings with 3-in. sections were used in these studies because: (1) A large section would produce more pronounced defects. (2) The temperature of metal and condition of moulding sand would not influence the results in a heavy section so much as in a lighter one. (3) Sections so large are not uncommon in heavy machine and structural castings, and are sometimes isolated in castings where it is not practical to feed except through the arms. (4) It is believed the information obtained from chilling these sections may be applied to either heavier or lighter sections with corresponding results.

* Briggs, C. W., Gezelius, R. A., and Donaldson, A. B., "Steel Casting Design for the Engineer and Foundryman," Trans. A.F.A., vol. 46, pp. 605-672 (1938).

The effect upon solidification caused by the use of different radii at the junctions was studied, and chills were designed to meet the different problems. Cast chills were used in all applications. Some of the chill treatments given to these sections were novel, and had varying degrees of success, all of which will be noted later in discussing the results.

Etching Treatment.—The castings for illustrations used in this discussion were prepared by removing the arms a short distance from section junctions. The junctions were then burned through the centre, plan view, ground and etched for 20 min. in boiling 1 to 4 sulphuric acid solution. This treatment is believed sufficient to make all harmful defects visible.

(To be continued.)

Tarnishing of Stainless Steel

The assumption that stainless steels are more resistant to initial oxidation is a misconception, for any piece of iron or steel, when it is first exposed to the atmosphere, is immediately covered with a thin film of oxide, sometimes called the passive film. This initial film on stainless steel protects the metal from further oxidation under these conditions and the surface remains bright because the film is so thin as to be invisible. On the other hand, the initial film on ordinary iron and steels does not prevent further oxidation, and the film increases in thickness until it becomes visible, *i.e.*, the metal tarnishes. The resistance of stainless steel to tarnishing is, therefore, an indication of the protective action of the initial film of oxide, rather than of the complete absence of any oxidation.

The non-tarnishing property of stainless steel applies particularly to atmospheric exposure. When stainless steels are heated to elevated temperatures in air they develop temper colours as do ordinary irons and steels, although it requires a higher temperature or a longer time to develop a given temper-colour on stainless steel. Under other conditions stainless steel may tarnish as readily as, or more readily than, ordinary iron and steel, as was observed in some recent experiments conducted by V. C. F. HOLM, of the U.S. Bureau of Standard's Metallurgy Division, which involved heating specimens of various metals to temperatures between 700 and 800 deg. C. in a high vacuum.

Under these conditions specimens of stainless steel, either the cutlery type with 12 per cent. of chromium or 18 chromium:8 nickel steel, were decidedly tarnished, whereas iron and many types of steel, including low-chromium steels with not more than 5 per cent. of chromium, remained bright. Not only did ordinary iron fail to tarnish under these conditions, but tarnish films which had been formed by prior heating of the specimens in air were completely removed by this treatment. Specimens of stainless steel could be annealed without tarnishing only at temperatures above 1,000 deg. C.

These results are representative of the relative stability of the oxide films on the two types of materials. At elevated temperatures and in vacuum the oxide films tend to decompose and this tendency increases with increasing temperature. Under the conditions of these experiments the film on ordinary iron or steel decomposed below 700 deg. C. but the film on stainless steel was stable up to about 1,000 deg. C. These observations are in accord with the facts observed in commercial practice, that it is more difficult to "bright-anneal" stainless steel than ordinary steel, although the stainless steel is easier to keep bright at ordinary temperatures.

Government's Power of Control

On August 13 a motion by order came before Mr. Justice Bennett in the Chancery Division. It related to a "test" motion brought by E. H. Jones (Machine Tools), Limited, and the right of the Ministry of Supply to take control of companies and undertakings for the efficient prosecution of the war. It was stated that on July 17 last Mr. E. H. Jones received from the Ministry of Supply a document informing him that by virtue of paragraph 55 (4) of the Defence Regulations, 1939, the Minister, as the competent authority under the Emergency Powers (Defence) Act, 1939, had authorised the defendants, Mr. Edward Charles Farrell and Mr. Eric William Muirsmith, to carry on the undertaking of the plaintiffs as from July 17, 1940. His Lordship, however, held that the regulation under which the Minister of Supply had acted exceeded the powers conferred on him under the Emergency Powers (Defence) Act, 1939, and was invalid, and granted the plaintiffs an interim injunction restraining the defendants from interfering with the control and management of the plaintiffs' business, and from instructing the plaintiff company's bank not to honour any cheques drawn on their banking account. On August 8 an application was made to his Lordship *ex parte* on behalf of the defendants for leave to serve notice of motion for an order discharging the injunction on the ground that paragraph 55 (4) of the Defence Regulations, 1939, had been revoked by the Minister and replaced by a new regulation. In consequence, his Lordship suspended the operation of the injunction.

Injunction Discharged

Sir Donald Somervell, K.C., Attorney-General, said the defendants had taken out a notice of motion asking that the injunction granted by his Lordship should be discharged. The parties had been in negotiation and that motion would not be opposed. Subject to the approval of the Court, the parties had agreed that the injunction should be discharged and that all further proceedings in the action should be stayed. In announcing this settlement, the Attorney-General remarked that while the Minister considered it necessary in the case of this company to exercise his powers of control, it must not be taken as involving any personal reflection on Mr. Jones, who had assured the Minister of his support in the national effort.

Mr. W. P. Spens, K.C. (for the company), said that the new order met the two points on which the original order was criticised. It made the managers not the agents of the company but of his Majesty, and the excessive powers to do whatever the managers thought fit had been substantially restricted. Counsel added that since August 8 the defendants had been in as managers of the company under the new order. In the circumstances he consented to the injunction being discharged on the terms that the motions should be treated as the trial of the action and the defendants would pay the company's costs.

The Attorney-General agreed to the payment of the plaintiffs' costs, and his Lordship ordered that the injunction should be discharged by consent, that all further proceedings in the action should be stayed, and that the defendants should pay the plaintiffs' taxed costs.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Adaptor Engineering Company, Limited, Cwmdu Foundry, Cwmbwrla, Swansea—Capital £1,000.

Sunleys (London), Limited—Capital £10,000. Engineers, etc. Director: G. E. Hazell, 136, Wood Lane, Isleworth, Middlesex.

F. Atkinson & Sons (London), Limited, 65, King's Cross Road, London, W.C.1—Capital, £500. Mechanical engineers, founders, smiths, etc.

Carlton Metal Moulding Company, Limited, 3, Taybridge Road, Battersea, London, S.W.—Capital, £2,000. Directors: R. W. and W. Goldsworthy.

Northern Ironfoundry, Limited, 24, Quarry Road, Thornton, Liverpool, 23—Capital, £1,000. To take over the business carried on as "The Northern Manufacturing Company," at Freemasons Row, Liverpool. Directors: S. and E. Davies.

For High Quality Castings

The increasing demand for high-strength close-grained iron castings calls for improved metal. In comparison with the accepted standards of the past, the modern high quality casting requires lower total carbon and phosphorus, with a closer range in silicon. The Ironfounder can now meet this demand at a reasonable cost by the use of Stanton-Dale Refined Pig Iron.

Stanton-Dale is a pig iron of low total carbon, the graphitic carbon being uniformly distributed and of fine curly-flake formation. The close structure ensures remarkably high strength with good machineability, and Tensiles of 16 to 20 tons can readily be obtained when a proportion of Stanton-Dale Iron is introduced.

The use of this iron avoids the irregularities in structure which are sometimes observed when steel scrap has formed part of the charge.

The correct grade of Stanton-Dale Iron to use depends on the type and class of castings to be made. The Stanton Technical Service is available to advise on suitable mixtures.

Total Carbon from 2.6 per cent. upwards. *Analysis to individual specification as required.*

STANTON-DALE
REFINED PIG IRON

The Stanton Ironworks Company Limited, Near Nottingham

***The Largest** Producers of Foundry Pig Iron (for Sale) in Great Britain*

Some Jobbing Foundry Experiences—IV

By "TRAMP"

A typical casting often required from jobbing foundries is a grating for a particular make of domestic stove or fireplace. Often the customer has failed to obtain a casting from the makers of the original because of their ceasing business or having withdrawn that particular type from production. Unfortunately each customer requires a slightly different grating as regards shape and size, and if the jobbing founder made a pattern for each grating his margin of profit on these jobs would be very small. A method whereby a grating of different form from the nearest pattern available can be easily made is explained below.

Supposing a casting as shown in Fig. 1 is required, and the only pattern in hand is as outlined in Fig. 2. A piece of wood is obtained

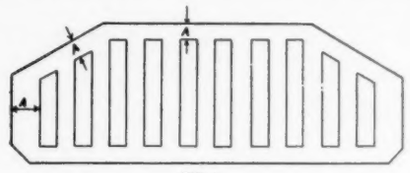


FIG. 1.

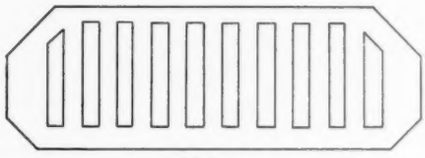


FIG. 2.

as a pattern of the exterior shape and thickness of the casting required. A plain bottom part of a mould is rammed up and the piece of wood placed on it; parting sand is dusted around and the top box rammed up. The boxes are parted and the pattern is withdrawn. On the bottom half there is distinctly marked an outline of the casting. On this the pattern of the bars is placed and the bars rammed up and the pattern withdrawn. Any pieces of sand protruding beyond a margin the width of the required bar A (Fig. 1) is cut off. This is clearly indicated by the marks on the bottom defining the shape of the exterior. Having made the mould for the bars on the bottom half, the top half carrying the outside shape is placed on and the job made ready to cast. This method is a time-saver in many ways, and reliable castings can be produced for the minimum of outlay.

A New Element

Switzerland, encircled by nations at war, has just made a constructive contribution to human knowledge, and perhaps eventually to human welfare, in the form of the discovery of a new chemical element, that with an atomic number of 85 in the Periodic Table. Dr. Minder, of Berne University, has isolated the element, which is produced in small quantity on the disintegration of the radio-active element actinium of atomic number 89. He has named it Helvetium in honour of Switzerland. The element is in group 7 of the Table, which includes the four halogens, manganese, masurium and rhenium, the last two also of recent discovery. Its general chemical and physical characteristics are thus midway between those of the halogens and the radio-active elements. The discovery of this element leaves only one place unoccupied in the Periodic Table, that for an element with atomic number 87 to terminate the group hydrogen, lithium, sodium, potassium, copper, rubidium, silver, caesium and gold.

Estimation of Copper in High-Duty Cast Iron Containing Molybdenum

By J. STOTT

With the introduction of alloy cast irons which day to day grow more complex, methods of analysis have constantly to be revised and in some cases new methods sought. The works chemist only discovers that the methods he formerly used on ordinary irons give erroneous results on applying them to the complex type of irons used to-day. Austenitic cast irons and high-molybdenum copper irons are types of irons which require new methods, as previous methods outlined in textbooks and other publications are merely applications of the so-called straight methods. Normally the routine laboratory has to treat this type of cast iron as a special job, employing methods which require a maximum of time with its attendant delay to the foundry, as accurate results are essential, especially when dealing with expensive alloying additions.

In analysing high-duty cast iron containing copper and molybdenum, the copper estimation presents some difficulties due to the interference of molybdenum. The method using sodium thiosulphate to separate the copper results in the co-precipitation of molybdenum sulphide, which interferes with the subsequent titration of the copper iodometrically. The usual method of separation of these two elements is fusion in sodium hydroxide and extraction of the melt with water. This, however, is a somewhat tedious procedure, and especially when several samples are being analysed together. The following method has been tried with success and also with a saving of time.

Five grms. of sample are dissolved in 100 ml. 1:5 sulphuric acid, and when solution is complete the liquid is diluted to 300 ml. with water. The liquid is then brought to the boil and 10 grms. sodium thiosulphate added carefully and the solution boiled for 15 mins., to expel SO_2, and to coagulate the precipitated mixed sulphides. The liquid is then filtered through a paper pulp pad and washed well with water saturated with hydrogen sulphide and acidulated with sulphuric acid. The pad and precipitate are transferred to a porcelain crucible and carefully ignited at approximately 550 deg. C. The ignited precipitate is then transferred to a small beaker and dissolved in 10 ml. hydrochloric acid, to which have been added a few drops of concentrated nitric acid.

When solution is complete the liquid is diluted slightly and made ammoniacal, sufficient ammonia being added to hold the copper in solution. It is then boiled for 2 mins. and filtered, washing well with 2 per cent. ammonia solution. The liquid is then diluted to 250 ml. and brought to the boil, and 15 ml. of a 2 per cent. solution of alpha benzoin oxime added and boiled for 2 mins. Some paper pulp is added and the solution filtered and washed well with hot 2 per cent. ammonia solution, transferred to a crucible and ignited to copper oxide. This may be weighed as such or dissolved in a minimum quantity of nitric acid, evaporated to low bulk, diluted with water, sodium carbonate solution added, and the precipitate dissolved in acetic acid, then boiled to expel carbon dioxide, cooled, potassium iodide added and the liberated iodine titrated with sodium thiosulphate solution.

Satisfactory results have been obtained by this method on cast irons containing approximately 0.5 per cent. copper and up to 1 per cent. molybdenum.

Acknowledgments are due to Hepworth & Grandage, Limited, Bradford, for permission to publish these details.

New American Cast-Iron Research Organisation

MR. CLYDE E. WILLIAMS, Director, Battelle Memorial Institute, Columbus, Ohio, has announced that the recently-organised Grey Iron Research Institute is to conduct a programme of foundry research at the Battelle Institute. The Grey Iron Research Institute is chartered as a non-profit corporation, to engage in scientific research and technical development work for the grey iron industry.

As a first part of the programme it is planned to conduct studies of the fundamental principles of the cupola melting of grey cast iron, using the combined laboratory facilities of the fuels and metallurgical laboratories as well as the experimental foundry at Battelle. It is expected that these investigations will provide the groundwork for more accurate control of metal quality and composition and that the technical information obtained in the operation of the experimental cupola will indicate to the member foundries the changes in practice and the degree of control necessary to obtain the highest quality metals at the lowest operating costs.

The experimental programme at Battelle will be under the direction of Dr. C. H. Lorig (supervising metallurgist) and Mr. R. A. Sherman (head of the fuels division of Battelle Memorial Institute). Mr. John Lowe (foundry engineer on the Battelle staff) will serve as contact officer between the laboratories and the member foundries, so that the results obtained in the research programme can be translated into practical foundry operations without loss of time.

Synthetic Moulding Sand

(*Continued from page* 124.)

ticity. It does not impair porosity in any way, unlike natural sands, for the clay they contain always results in a considerable diminution of permeability. The property possessed by "Geko" of imparting high plasticity to moulding sands of low binder content is due to the fact that the colloidal suspension which it forms with water spreads evenly over the surface of the grains in the form of a plastic film of adhesive, without leaving any granular residue which would reduce the pore volume of the grain structure.

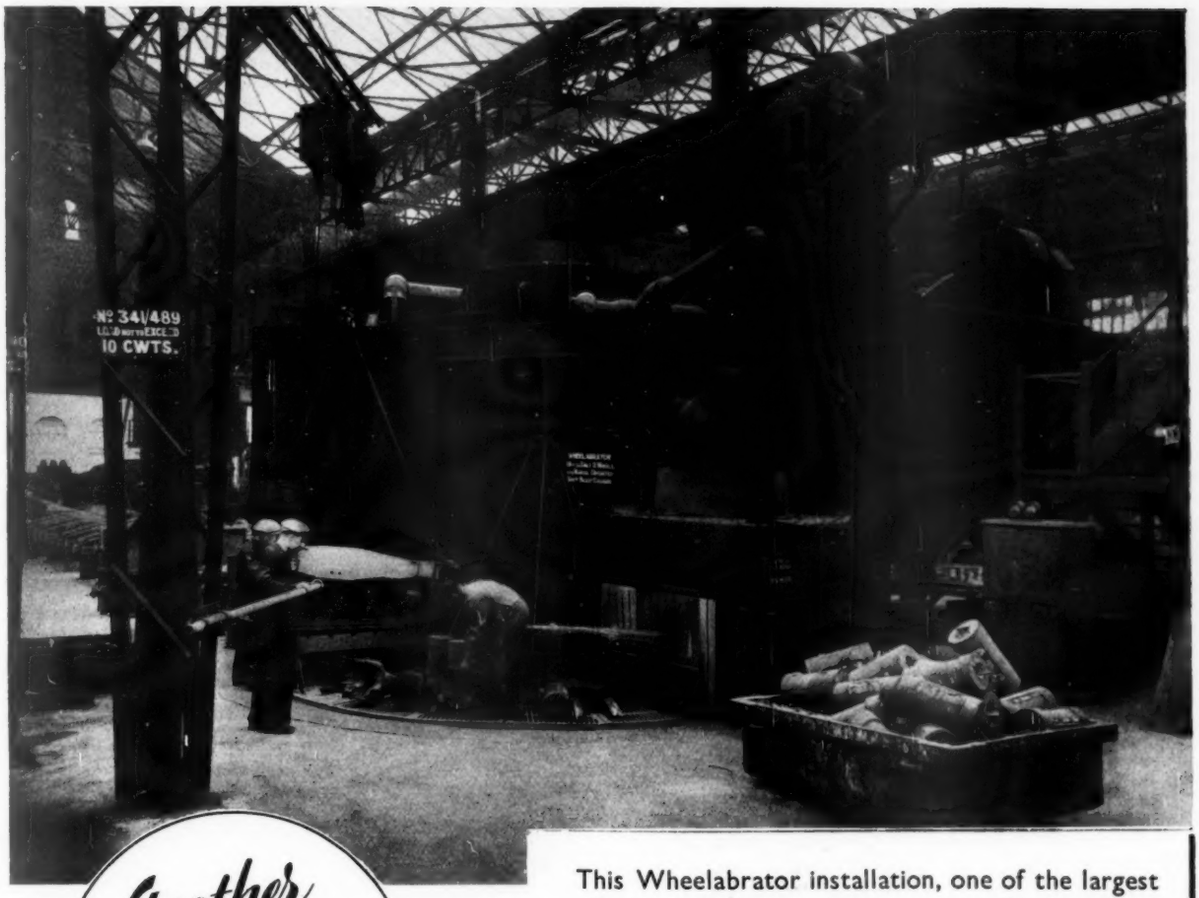
Various clays possess the same property, although to a very limited extent, and this suggests that they might be used in the same way. Clay, however, leaves a very considerable quantity of dust in the moulding sand, particularly when large quantities of clay are required in order to impart to a given moulding sand the plasticity imparted to it by a very small amount of "Geko" without leaving any ill effects.

By adding small quantities of "Geko" to old sand which would otherwise be useless to the foundry, the moulding properties are restored to the old sand. This regeneration of old sand is illustrated in Table II.

In the case of complicated castings, however, it is customary in any foundry to employ facing sand, because a regenerated old sand is inadequate for such work.

Table III shows the increase in quality achieved in a facing sand by adding only 1 per cent. of Geko. Without impairing the permeability, the compressive strength and shear strength have been considerably increased.

Addition of "Geko" to old sand for ensuring the best moulding properties not only provides moulders with a high-grade moulding material, but, more important still, it effects a great saving in new sand and transport costs and reduces to a very low figure the wastage in sand which has to be discarded.



Another Wheelabrator Triumph!

This Wheelabrator installation, one of the largest of its kind, is in operation at the English Steel Corporation Ltd. It was specially adapted to deal with large cored castings. Two Airless Wheelabrator units are mounted in the cleaning chamber, and the rotating table, controlled by push button, brings the work under the blast streams. It then proceeds round to a Sand Blast room (seen on the left) where the portions of the work which the abrasive streams cannot reach are touched up by pressure blast.

Airless Wheelabrator equipment can be supplied in many standard designs, or adapted to deal with your special work. Write for full particulars.

TILGHMAN'S

PATENT SAND BLAST Co. Ltd.

BROADHEATH Nr. MANCHESTER

London Office : 17 Grosvenor Gardens, S.W.1

The Week's News in Brief

Trade Talk

NEARLY 3,000 FIRMS have already responded to the Minister of Supply's appeal for secondhand machine tools.

MR. HERBERT MORRISON, Minister of Supply, opened a scrap iron and steel exhibition at Charing Cross Underground station last Thursday.

A SECTION of the works of Gray & Caldwell, Limited, brassfounders, of Paisley, was recently destroyed by fire. Arrangements have been made to carry on business as usual.

VOLUNTARY WINDING UP is proposed by Buell Combustion Company, Limited, and the necessary resolution will be submitted at an extraordinary meeting in London to-day (Thursday).

HILLSIDE FOUNDRY, Burnside, Cupar, has been taken over on lease by Mr. W. L. Burns, managing director of Henry Balfour & Company, Limited, Durie Foundry, Leven, and associated firms.

THE SUPPLY of some classes of skilled men is in excess of the present and of the anticipated war-time demand. The Ministry of Labour has, therefore, decided to amend the Schedule of Reserved Occupations to make a larger number of such men available for service in the armed forces. The occupations affected include stove, grate, and range fitters and assemblers, and certain types of metal polishers, for whom the new reserved age will be 30.

MODIFICATION of the right of Government departments to take control of factories and undertakings for the efficient promotion of war work is announced in amendments to the Defence Regulations which have now been published. These provide that authorised controllers may not give directions inconsistent with a company's memorandum of association except in so far as may be specifically provided by the relative order. Obligations are laid upon the competent authority to communicate the effect of control orders to the undertakings thereby affected. The amendments are in substitution of a section of Regulation 55 of the Defence (General) Regulations, which has been revoked as the result of a recent Court case (see p. 126).

THE Ministry of Labour and National Service announces that further skilled tradesmen required to expedite the production of aircraft and armaments will shortly be released from service in the Army, which is now carrying out a detailed combout of men who had been regularly employed, prior to joining up, on certain important occupations and units. Particulars of these men are being scrutinised by the Ministry of Labour and those selected are being temporarily released at once. It is anticipated that several thousand more tradesmen will be returned to industry by this method in the course of the next few weeks. All the releases are being negotiated by the Ministry of Labour and National Service in consultation with the military authorities and, where necessary, with the firms concerned. Direct applications to the War Office or Ministry of Labour and National Service from firms for the return of their ex-employees should not, therefore, be made.

DESCRIBING the campaign for the collecting of old iron and steel, Mr. George Wood, Director of Scrap Supplies in the Iron and Steel Control, states that some 3,500 organisers of village dumps of old iron have been enlisted by that number of parish councils. With the aid of voluntary organisations and individuals they have assembled approximately 10,700 tons of scrap over a period of nine weeks; and the process still goes forward at the rate of 1,000 tons a week. An official of the Iron and Steel Control has been detailed to supervise and stimulate the work of collection. Unwanted iron railings are being collected at the rate of some 1,500 tons weekly. From wrecked ships another 1,000 tons a week are recovered. Mr. Wood lays emphasis on two points: first, that the consuming furnaces are being kept adequately supplied with scrap at present; secondly, that this satisfactory state of affairs would in no way justify any slackening of effort to maintain the flow.

SPEAKING in the House of Commons on August 13, Sir John Jarvis asked the Chancellor of the Exchequer why the import duties on steel rolls were removed on July 3 last; why the order giving effect to this was not brought to the notice of the House; whether he was aware that the result would be to give a preference to American roll makers, although rolls of equal, and even better, quality than those made in America were now being manufactured in England, many of them in a special area; and whether this was a reversal of the Government policy to save shipping space and reduce unemployment. In his reply Sir Kingsley Wood pointed out that the import duties on most varieties of machinery and parts, including steel rolls, were removed by the Treasury in view of the facts that such machinery and parts were no longer licensed for import unless they were necessary in the public interest and unprocurable in this country, that a large proportion of such imports was already admitted duty free under licence, and that most of the duty actually paid was ultimately borne by the Government. He believed that this decision was generally welcomed. The Chancellor said he announced the decision in the House on July 4, in reply to a question, and the relevant Treasury Order was presented to the House in accordance with the law on July 9. The suggestions made in the third and fourth parts of the question must, he thought, be based on a misapprehension. The Order would have no effect on the volume of steel rolls imported into this country, since every such importation required a Board of Trade import licence which would only be granted if home supplies were inadequate.

Unauthorised Use of Symbols

The Iron and Steel Control informs us that a number of contractors have been using symbols without first obtaining the written authorisation of the Department concerned. In some cases, failure to obtain the necessary authority has resulted in contractors using the wrong symbols. The Control emphasises that in every case sanction in writing should be obtained from the appropriate Department before applying a symbol to a job, or jobs. Sub-contractors should obtain written confirmation from the main contractors. A serious view will be taken in future by the Ministry of Supply of any failure to comply with these regulations.

Personal

MR. ALEXANDER BAIRD, of Larbert, secretary for 22 years of the Ironfounding Workers' Association (Northern District), has retired. He has been presented with a clock by representative delegates and members of the committee.

SIR HAROLD YARROW, chairman of Yarrow & Company, Limited, engineers and boilermakers, Scotstoun, has been appointed president and Mr. Willom Elger, secretary of the Scottish T.U.C., vice-president of the Scottish area board to speed up industrial production for war work.

HIGH DUTY ALLOYS, LIMITED, announce that Mr. H. G. Herrington, Mr. S. Sanders and Mr. W. E. Prytherch have been elected to the board of the company. These gentlemen occupy positions as general manager, personal assistant to the managing director, and chief metallurgist respectively.

MAJOR-GENERAL K. C. APPLEYARD, who has been promoted temporary brigadier by the War Office, is chairman of the North-Eastern Trading Estate, Limited, Gateshead, and a member of the management board of the Engineering and Allied Employers' Federation. He is one of four members of the Labour Supply Board which was set up to ensure the fullest use of all man-power and woman-power. Major-General Appleyard is managing director of the Birtley Company, Limited, of Birtley Ironworks, Birtley, Co. Durham, and is also on the board of other industrial concerns.

MR. J. SINCLAIR KERR, assistant managing director of the Lancashire Steel Corporation, Limited, Warrington, who received the decoration of Officer Brother of the Venerable Order of St. John of Jerusalem in 1936, has now been appointed District Officer of No. IV (Lancashire) District of the St. John Ambulance Brigade. He has also been appointed a representative of the St. John Ambulance Brigade on the East Lancashire Joint County Committee of the British Red Cross and St. John Associations. Mr. Kerr, who is a member of the Grand Council of the Federation of British Industries, is a director of Pearson & Knowles Coal & Iron Company, Limited, Wigan Coal Corporation, Limited, and is chairman of William Robertson, Limited, steelmakers, of Warrington. Last year he was elected Member of Council of the Iron and Steel Institute.

MR. J. M. DUNCANSON has succeeded Mr. Ralph Alsop as Deputy Controller of Steel Supplies under the Ministry of Supply. Prior to the outbreak of war Mr. Duncanson joined the Iron and Steel Control as Director of Heavy Steel, including semi-finished steel and shell steel. He was later appointed to the position of Assistant Controller of Steel Supplies. Mr. Duncanson is a director of the Steel Company of Scotland, and deputy-chairman of R. Y. Pickering & Company, Limited. He is also on the board of the Glasgow Railway & Engineering Company, Limited. These companies have seconded Mr. Duncanson, who has been given leave of absence so as to devote his services whole-time to the Control. Mr. Duncanson has been succeeded in the position of Assistant Controller of Steel Supplies by Mr. A. G. E. Briggs, who was formerly the Director of Alloys, Special Steel and Ferro-Alloys for the Control.

Wills

OSBORNE, GEORGE FRANCIS, managing director of Lanceley's, Limited, ironfounders, of Chester £5,094

WOLSTENHOLME, G. E., local director of Thomas Firth & John Brown, Limited, steelmakers, of Sheffield ... £12,696

SCOTT, ROBERT GRIGOR, chairman and governing director of MacTaggart, Scott & Company, Limited, hydraulic and general engineers, of Edinburgh £28,070

LYSAGHT, DANIEL CONNER, managing director of John Lysaght, Limited, Newport, Mon., and a director of Joseph Sankey & Sons, Limited, Bilston £81,869

Obituary

MR. E. J. DAVIES, secretary and director of Plenty & Son, Limited, Eagle Ironworks, Newbury, Berks, died recently.

MR. WILLIAM JOSEPH HASKING, who was for 26 years with John Williams & Sons (Cardiff), Limited, ironfounders, iron and steel stockholders, died recently.

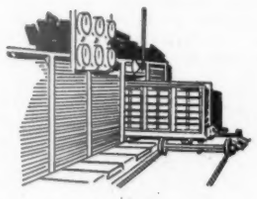
MR. DAVID HIGGINS, secretary of the Clyde Shipbuilders' Association and the North-West Engineering Trades Employers' Association, died in a Glasgow nursing home last Saturday.

THE DEATH has occurred at Clydebank of Mr. John M'Lennan, M.B.E., foreman of the machine department of John Brown & Company, Limited, Clydebank, for many years.

MR. WILLIAM HENRY TONKS, whose death is announced at the age of 70, was chairman and managing director of Tonks (Birmingham), Limited, brassfounders. He had been connected with the business for 52 years, and on the death of his father he became chairman of the company.

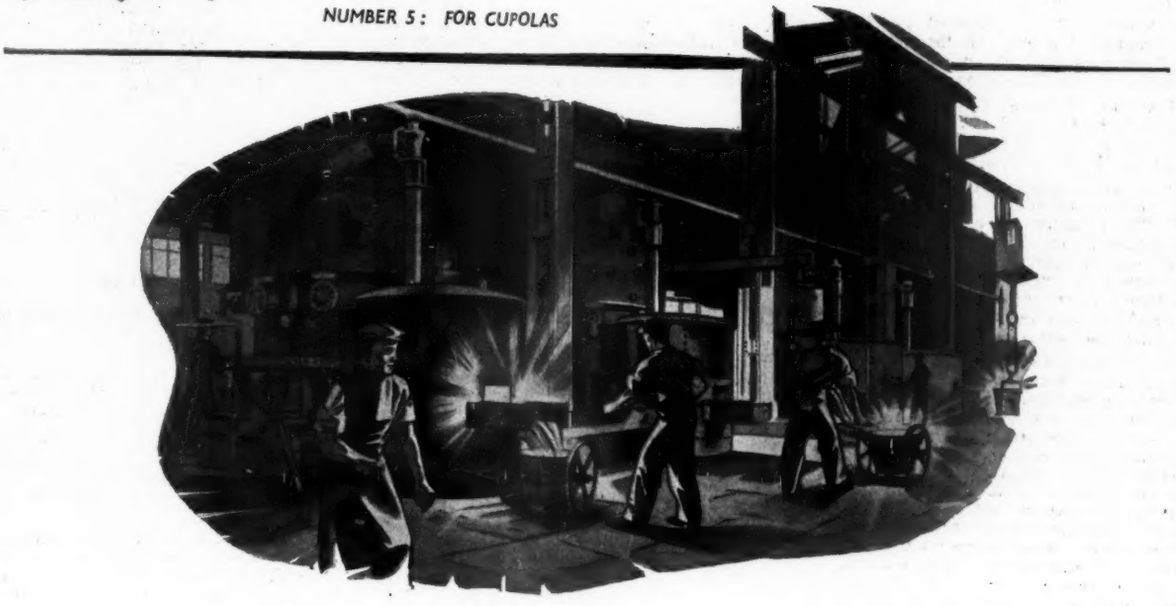
MR. FREDERICK BEST, who has died at the age of 74, was a director and secretary of Thos. Firth & Sons, Limited, of Sheffield, prior to the fusion of the company with John Brown & Company, Limited. He was also the company's nominee director of the Firth-Brearley Stainless Steel Syndicate, Limited, of High Speed Steel Alloys, Limited, Widnes, and Firth-Derihon Stampings, Limited, Sheffield. His first appointment with Thos. Firth & Sons, Limited, was as head of the steel foundry department. He travelled widely in the company's interests in the United States, Canada, Russia, and elsewhere. He was a member of the Council of the Sheffield Chamber of Commerce and of the Federation of British Industries. During the 1914-1918 war he was hon. secretary of the Aircraft Steelmakers' Committee, and was appointed by the Minister of Munitions a member of the High Speed Steel Advisory Committee.

REFRACTORIES ON PARADE



YEARS OF RESEARCH HAVE RESULTED IN THE PRODUCTION OF FOUNDRY REFRACTORIES OF PROVED RELIABILITY

NUMBER 5: FOR CUPOLAS



A careful study of the exacting requirements necessitated by modern cupola operating conditions has resulted in the production of cupola refractories which will withstand the most severe conditions to be encountered.

The Technical Department will be pleased to advise on all problems relating to the application of cupola refractories and to make recommendations regarding the most suitable material for individual requirements.

Firebricks:
HYCONE
STOUR
WHITE CARR
GLENBOIG
etc., etc.

Daubing Materials:
HAZLEHEAD
GROUND
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Represent maximum output

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Raw Material Markets

The supply of foundry iron, on the whole, is sufficient to meet the needs of Government contractors, but where possible consumers are adjusting their mixtures, as certain grades of iron are anything but free. Although foundries engaged on ordinary domestic orders are unable to acquire all the iron they would like, priority users are being supplied with adequate tonnages. Heavy engineering concerns are the best situated establishments in the foundry trade, but increasing numbers of light-castings makers report more satisfactory conditions now that Government departments are able to make additional use of their plants. In a statement issued during last week-end the Iron and Steel Control point out that it has come to their notice that a number of contractors have been using symbols without first obtaining the written authorisation of the department concerned. In some cases, failure to obtain the necessary authority has resulted in contractors using the wrong symbols. The Ministry of Supply will, in future, take a serious view of any failure to comply with the regulations.

Pig-Iron

MIDDLESBROUGH—Foundry-iron users continue to obtain quite satisfactory tonnages of iron from the Midlands, and firms working on Government contracts are experiencing no difficulty in maintaining full-scale operations. At times it becomes necessary to rearrange users' mixtures, but this can often be done without involving any real inconvenience. Distribution of supplies is being made with care, and it may become essential to recommence the manufacture of Cleveland foundry iron on a moderate scale, so as to relieve the pressure on the Midlands makers, who have heavy calls on their outputs from many districts. The hematite position is firm, and producers are concentrating on meeting the needs of works on contracts of national importance. Business can only be conducted on a week-to-week basis.

LANCASHIRE—Licensed deliveries of Midlands foundry iron continue to reach this area on a good scale, and the more urgent requirements are being met satisfactorily. Light-castings makers are still only taking a small part in Government work, but other orders are helping to maintain moderate operating conditions in this branch. Most other iron users are busy, and consumption is heavy. Hematite is in good request, and deliveries are fairly satisfactory, most of the iron being of West Coast grades.

MIDLANDS—High-phosphorus iron is being used in increasing tonnages to supplement the supply of low-phosphorus iron and hematite, which is fully taxed. Thus, ordinary domestic users of high-phosphorus material are being rationed, as the tonnage available is not large, output having been at a low ebb for some time past owing to certain producing units having been transferred to the manufacture of other qualities. Trade with makers of light castings has been anything but good since the outbreak of hostilities, as the amount of war work offered to these concerns has not been sufficient to counteract the closing of peacetime outlets. Export trade must inevitably remain quiet, while supplies of iron available to light-castings foundries are curtailed and, on the whole, the outlook for this section is rather disappointing. There is no lack of work for heavy engineers, whose order-books are crowded with Government specifications. Many of them are incorporating high-phosphorus iron in their mixtures where this is practicable, but, generally speaking, good deliveries of iron are being despatched to consumers.

SCOTLAND—Midlands makers of foundry iron are releasing sufficient material to buyers here to enable work to continue uninterrupted, but there is no surplus or facilities for accumulating reserves, which would be especially useful to the heavy engineers. No better reports are forthcoming from the light-castings trade and only moderate conditions are prevailing, as the amount of Government work placed so far has been meagre compared with the loss wrought by the advent of war conditions.

Coke

The call for deliveries of foundry coke is substantial, but ovens are in a position to meet consumers' requirements without delay. Many users now have considerable stocks in hand. The current price of 55s. 6d. per ton for best Durham coke, delivered Birmingham and Black Country stations, is unchanged, but is subject to alteration by the Control authorities at any time.

Steel

In a well-timed speech over the week-end the Minister of Supply, Mr. Herbert Morrison, refuted the baseless Nazi allegations that Britain was starved of raw materials for the manufacture of steel, and added that substantial tonnages of finished steel had recently been imported from the United States. Current outputs of British steelworks are sufficient evidence that the trade is anything but starved of raw materials, and, in fact, the position in this respect is actually improving. Larger tonnages of scrap metal are being delivered to the producing works, and there has been a decided easing of the pressure of demand in certain instances. Government requirements account for practically the entire output of steel, but increasing provision is being made for export to approved destinations, and further expansion in this direction is anticipated. All descriptions of steel are heavily contracted, but particular strength is noted in shipbuilding requisites, while there is continual expansion of the demand in connection with the manufacture of shells, guns and other armaments.

Scrap

Supplies of iron and steel scrap generally appear to be rather easier, but there is a ready market for all that becomes available, and it is not yet possible for stocks of any size to be laid down. The situation in the scrap trade has improved in a very gratifying manner during the past few months since new sources of supply have been tapped and existing sources more thoroughly combed out. In addition to home-produced scrap, fairly large quantities of imported material have resulted in a much more satisfactory situation at the consuming works.

Metals

With the exception of ordinary domestic users of copper, who continue to experience considerable difficulty in getting their requirements met in full, consumers are receiving satisfactory supplies under licence. Contractors on Government lists are well satisfied with the present position, while permission to export copper, both in finished and semi-finished products, to approved destinations, is now granted quite freely, indicating the confidence of the Non-ferrous Metals Control in the future supply. Consumption continues to be heavy in connection with munitions production and other Government needs, and it is certain that there will be no falling away in this respect, but. in spite of this, the sources of supply are sufficient to facilitate the carrying on of a moderate amount of overseas trade. The Axis partners, on the other hand, do not appear to be devoid of difficulties as far as copper supplies are concerned. Germany must have sufficient metal to meet her short-term consumption, but the acquisition of Holland, Belgium and France has by no means relieved the forward position, which remains very uncertain. Italy is having to proceed very cautiously, and copper consumption is restricted to military needs. Her own production is very small, and of her imports the bulk is generally seaborne, but the British blockade is sufficiently powerful to control further shipments, and the Italian authorities cannot be feeling too happy about future supplies of copper.

There is little fresh to report regarding the London tin market. Trading in the metal continues to be somewhat desultory. The Tin Producers' Association, in a statement issued over the week-end, declared that serious consequences to the Empire tin industry will result from the Government's decision not to modify the Excess Profits Tax in its application to tin mines and other short-lived mineral industries. Imposition of 100 per cent. E.P.T. on short-lived mines—such as the majority of Empire tin mines—is equivalent, it is stated, to confiscation of capital assets. Tin producers, it will be recalled, last week appealed to the Chancellor of the Exchequer for relief from the E.P.T. in its existing form, but during the debate on the Finance Bill an amendment on this question was withdrawn.

London Metal Exchange tin prices this week have been as follow:—

Cash—Thursday, £263 to £263 5s.; Friday, £263 to £263 5s.; Monday, £262 to £262 10s.; Tuesday, £261 10s. to £261 15s.; Wednesday, £261 to £261 10s.

Three Months—Thursday, £263 10s. to £263 15s.; Friday, £263 15s. to £264; Monday, £262 10s. to £262 15s.; Tuesday, £262 to £262 5s.; Wednesday, £261 15s. to £262.

Supplies of spelter are more than adequate to meet Government requirements, and there is metal available to meet inquiries from overseas for manufactured zinc goods. This position has been brought about, and can only be maintained, by the continued and generous support of the Empire producers. There is also a large quantity of lead free to be exported in the form of manufactured products, and licences for this purpose are generally granted quite freely.

Reports and Dividends

Ransomes & Rapier, Limited—Interim dividend of 3 per cent., tax free.

Kay & Company (Engineers), Limited—First and final dividend of 12½ per cent.

Cornercroft, Limited—Full report shows: Net profit, £46,250; allocated to tax, £17,500; to reserve, £5,000; carried forward, £3,275.

Head, Wrightson & Company, Limited—Net profit for year to April 30, £22,516; provision for taxation, £81,000; ordinary dividend of 6 per cent.; carried forward, £21,612.

James Howden & Company, Limited—Profit for the year to April 30, £84,785; brought in, £18,659; taxation, £30,051; to general reserve, £20,000; ordinary dividend of 15 per cent.; carried forward, £17,693.

Manley & Regulus, Limited—Net profit for the year to April 30, £13,582; brought in, £21,151; final ordinary dividend of 5 per cent., making 10 per cent. for the year; A.R.P. expenditure written off, £869; carried forward, £19,711.

Darlington Railway Plant & Foundry Company, Limited—Trading profit for the year to April 30, £12,648; additional income, £57; depreciation, £2,037; written off investment, £200; reserve for contingencies, £2,500; reserve for taxation, £4,500; interim dividend of 2½ per cent. on the ordinary shares, £682; brought in, £3,154; dividend on the 5 per cent. non-cumulative preference shares, £390; final dividend of 7½ per cent. on the ordinary shares, £1,969; carried forward, £3,580.

Emergency Power and Lighting Plant

The last issue of the "Crossley Chronicle," the house organ of Crossley Bros., Limited, Manchester, 11, contains an illustrated description of various types of portable and stationary emergency power and lighting sets. Not only are such plants suggested for A.R.P. emergency duty, but also for electric-supply authorities serving remote villages by overhead lines liable to be damaged by heavy snowfall. Some of these stand-by sets are of quite large capacity, being of 225 b.h.p. Amongst the portable ones illustrated is an 80-kw. machine supplied to an electric power company.

Corrosion-Resistant Ferrous Alloys Suitable for Casting

In a patent (U.S. No. 2,185,987) granted to Mr. James A. Parsons, jun., and the Durion Company a specification is given for alloys containing Ni 23 to 30, Cr 17 to 22, Si 0.5 to 2, Cu 3 to 5, Mo 2 to 4 and C up to 0.12 per cent., the remainder being practically all Fe (the Mo always predominating over Si, and both together not exceeding 5 per cent.). It is stated that such alloys are resistant to corrosion, have good casting properties and good cold-bending properties as cast (a standard specimen as cast withstanding a cold bend of at least 90 deg. without failure).

...TRADE... SIROCCO ...MARK...

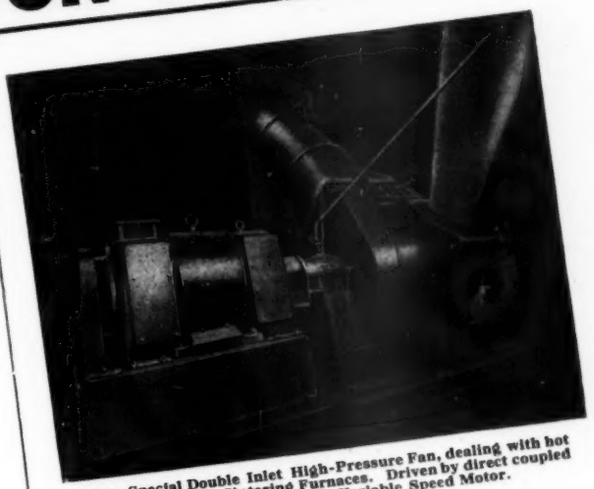
High-Pressure FANS FOR FOUNDRIES

- FORGE FANS
- CUPOLA FANS
- STEEL PLATE FANS

"Sirocco" High Pressure Fans have been designed for the comparatively high pressures which are necessary in connection with the supply of air blast to Forges and Cupolas, or for work of a similar character. The Fans are soundly constructed to give hard and continuous service with a minimum of attention.

MANUFACTURED IN A WIDE RANGE OF SIZES AND DESIGNS

Write for a copy of Publication Ref. SF 26



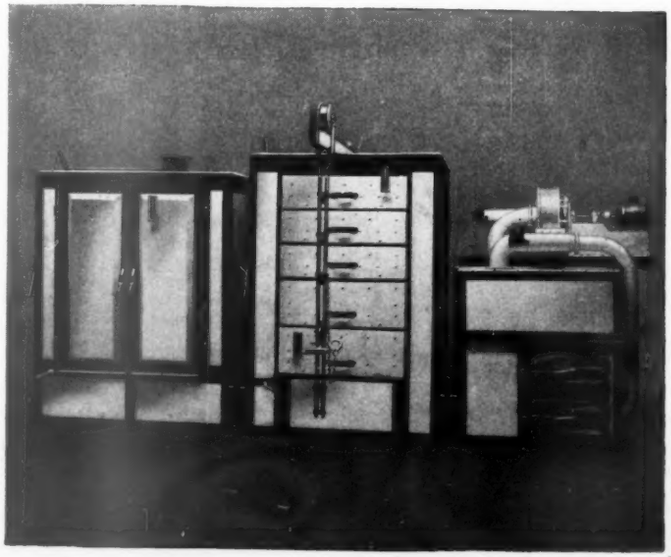
50-ins. Special Double Inlet High-Pressure Fan, dealing with hot gases from Spelter Sintering Furnaces. Driven by direct coupled 110 B.H.P. 440 Volt. D.C. Variable Speed Motor.

DAVIDSON & CO., LTD., SIROCCO ENGINEERING WORKS, BELFAST
LONDON · MANCHESTER · GLASGOW · NEWCASTLE · BIRMINGHAM · CARDIFF · DUBLIN · BRISTOL

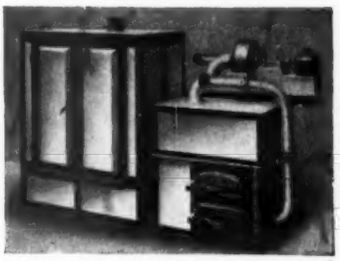
Almost 60 years' experience is behind the trade mark "SIROCCO"

Bomb and Grenade Production demands

HIGHEST CORE-QUALITY with MAXIMUM CORE-DRYING OUTPUT



The coke-fired Combination "Korex" Tray Type and "Superkor" Drawer Type Core Stove will handle the output of
20 Coremakers



The coke-fired "Korex" Tray Cabinet Type Stove with single cabinet will handle the output of
10 Coremakers

INSTALL A TITAN PORTABLE CORE STOVE

THE CONSTRUCTIONAL ENGINEERING Co LTD
Titan Works, Birmingham, 12.
Tel. MID. 4753-4 Telegrams "Structural"

RAW MATERIALS—PRICE LIST

Wednesday, August 21, 1940

COPPER*

	£	s.	d.
Electrolytic	62	0	0
High-grade fire-refined ..	61	10	0
Fire-refined of not less than 99.7 per cent.	61	0	0
Do., do., 99.2 per cent. ..	60	10	0
Black hot-rolled wire rods..	65	10	0

TIN

Standard cash	261	0	0
Three months	261	15	0
Settlement	261	5	0
Official average Cash, July	265	15	2 1/4
Do. Three Months, July	265	9	4 1/4
Do. Settlement, July ..	265	14	6 1/4

SPELTER*

G.O.B. (foreign) (duty paid)	25	15	0
Do. (domestic)	26	10	0
" Prime Western " ..	26	10	0
Refined and electrolytic ..	27	5	0
Not less than 99.99 per cent.	28	15	0

LEAD*

Good soft pig lead (foreign) (duty paid)	25	0	0
Do., do., (Empire and domestic)	25	0	0
English	26	10	0
Sheets, home	34	10	0
Do. export, f.o.b. ..	30	0	0
Pipes, home	34	0	0
Do. export, f.o.b. ..	30	10	0
Tea lead (nom.)		—	

ALUMINIUM

Ingots	£110
Wire, 10g.	nom.
Sheets	nom.
Circles, 20/24g.	nom.

ZINC SHEETS, etc.

	£	s.	d.
Sheets, 10g. and thicker, ex works	39	2	6
Rolled zinc (boiler plates), ex works	37	2	6
Zinc oxide (Red Seal), d/d buyers' premises ..	28	7	6

ANTIMONY

English, 99%	90 0 0
Foreign Regulus, duty paid ..	90 0 0 to 93 0 0
Chinese, prompt shipment, c.i.f. ..	79 0 0 to 82 0 0

QUICKSILVER

Quicksilver, ex-w'hse London	54 10 0

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s. 0d.
Finished bars, 18% tungsten	3s. 10d.
Finished bars, 22% tungsten	4s. 4d.

Per lb. d/d buyers' works.

NICKEL SILVER, etc.

	Per lb.
Ingots for raising ..	9d. to 1/3
Rolled—	
To 9 in. wide ..	1/3 to 1/9
To 12 in. wide ..	1/3½ to 1/9½
To 15 in. wide ..	1/3½ to 1/9½
To 18 in. wide ..	1/4 to 1/10
To 21 in. wide ..	1/4½ to 1/10½
To 25 in. wide ..	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
to 10g.	1/6½ to 2/1½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/5½ upwards.

* Maximum prices per long ton delivered to buyers' premises.

FERRO-ALLOYS AND STEEL-MAKING METALS

(all prices nominal)

Ferro-silicon—	£ s. d.
25%	18 10 0
45/50%	21 10 0
75%	31 0 0
Ferro-vanadium—	
35/50%	15/6 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free ..	6/- lb. Mo.
Ferro-titanium—	
20/25% carbon-free ..	1/9 lb.
Ferro-tungsten—	
80/85%	5/1 lb.
Tungsten metal powder—	
98/99%	5/2½ lb.
Ferro-chrome—	
2/4% car.	—
4/6% car.	47 0 0
6/8% car.	47 0 0
8/10% car.	—
Ferro-chrome—	
Max. 2% car.	—
Max. 1% car.	—
Max. 0.5% car. ..	—
70% carbon-free ..	—
Nickel—99.5/100%	£190 to £195
"F" nickel shot ..	175 0 0
Ferro-cobalt, 98/99% ..	8/9 lb.
Metallic chromium—	
96/98%	3/9 lb.
Ferro-manganese—	
76/80% loose	18 0 0
76/80% packed	19 10 0
Metallic manganese—	
94/96% carbon-free ..	1/9 lb.

Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.

SCRAP*

	£ s. d.	£ s. d.
South Wales—		
Short heavy steel, not ex. 24-in. lengths.. ..	3 16 6	to 3 19 0
Heavy machinery cast iron	4 6 6	
Ordinary heavy cast iron	4 1 6	
Cast-iron railway chairs	4 6 6	
Medium cast iron ..	3 17 9	
Light cast iron	3 13 0	
Middlesbrough—		
Short heavy steel	3 14	3 to 3 16 9
Heavy machinery cast iron	4 11 3	
Ordinary heavy cast iron	4 8 9	
Cast-iron railway chairs	4 8 9	
Medium cast iron ..	3 19 0	
Light cast iron	3 14 0	
Birmingham District—		
Short heavy steel	3 9	3 to 3 11 9
Hematite ingot mould	5 10 9	
Heavy machinery cast iron	4 11 9	
Ordinary heavy cast iron	4 7 0	
Cast-iron railway chairs	4 7 0	
Medium cast iron ..	3 19 9	
Light cast iron	3 14 9	
Scotland—		
Short heavy steel	3 14	0 to 3 16 6
Heavy machinery cast iron	4 13 9	
Ordinary heavy cast iron	4 8 9	
Cast-iron railway chairs	4 13 9	
Medium cast iron ..	3 16 9	
Light cast iron	3 11 9	

* Delivered free to consumers' works in England and Wales. For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less. All prices: Plus 2½ per cent. dealers' remuneration: 50 tons and upwards over three months 2s. 6d. extra

PIG-IRON*

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	123/-
" No. 3	120/-
" No. 4	119/-
Forge No. 4	119/-
Hematite No. 1	131/-
Hematite M/Nos.	130/6
N.W. Coast—	
Hem. M/Nos. d/d Glas. ..	131/-
" d/d Birm.	142/6
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	121/-
" No. 3 fdry.	122/-
Northants forge	118/6
" fdry. No. 3 ..	119/6
" fdry. No. 1 ..	122/6
Derbyshire forge	121/-
" fdry. No. 3 .	122/-
" fdry. No. 1 ..	125/-
Phosphorus 0.5% to 0.75%	129/6
Phosphorus 0.1% to 0.5%	132/6
Scotland—	
Foundry No. 1, Grangemouth	119/9
" No. 3, Grangemouth	117/3
Cleveland No. 3, Glasgow	123/-
" " Falkirk ..	120/-
Scottish hem. M/Nos. d/d..	131/-
Sheffield (d/d district)—	
Derby forge	118/6
" fdry. No. 3 ..	119/6
Lincs forge	118/6
" fdry. No. 3 ..	119/6
W.C. hematite	136/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3 ..	125/-
Staffs fdry. No. 3	125/-
Northants fdry. No. 3 ..	123/6
Cleveland fdry. No. 3 ..	125/-
Cylinder and Refined Irons	
North Zone..	168/-
South Zone..	170/6
Refined Malleable	
Birmingham and S. Staffs ..	165/6
Cold Blast	
South Staffs	217/-

* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.

Basic:	£	s.	d.
Soft, u.t., 100-ton lots ..	10	10	0
Tested, up to 0.25% C. ..	10	15	0
Tested, 0.25 to 0.33% C.	10	17	6
Tested, 0.33 to 0.41% C...	11	0	0
Hard (0.42 to 0.60% C.)..	11	17	6
" (0.61 to 0.85% C.)..	12	7	6
" (0.86 to 0.99% C.)..	12	17	6
" (1% C. and up) ..	13	7	6
Silico-manganese	14	5	0
Free-cutting	12	10	0
Siemens Martin Acid			
Up to 0.25% C.	13	15	0
Case-hardening	14	12	6
Silico-manganese	14	10	0

Billets, Blooms and Slabs for Forging and Stamping.

Basic soft, up to 0.25% C. ..	12	2	6
Basic hard, 0.41 to 0.60% C.	12	10	0
Acid, up to 0.25% C. ..	14	5	0

Other Semi-products, etc.

Tin bars	10	7	6
Sheet bars	10	7	6
*Wire rods, soft basic ..	15	4	0
" hard basic ..	18	12	6
" free-cutting ..	17	12	6
" acid	22	3	6

* Subject to rebate.

FINISHED STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel bars, sections plates joists and hoops is obtainable in the home trade under certain conditions.]

	£	s.	d.
Plates, ship (N.E. Coast) ..	14	3	0
Boiler plts. (N.E. Coast) ..	15	0	6
Chequer plts. (N.E. Coast)	15	13	0
Angles, over 4 un. ins. ..	13	13	0
Tees, over 4 un. ins. ..	14	13	0
Joists, 3 in. × 3 in. and up	13	13	0
Rounds and squares, 3 in. to 5½ in.	14	13	0
Rounds under 3 in. to ⅛ in. (untested)	15	8	6
Flats—over 5 in. wide ..	13	18	0
" 5 in. wide and under ..	15	8	6
Rails, heavy, f.o.t. ..	12	15	6
Hoops	16	3	6
Black sheets, 24 g. (4 t. lots)	19	7	6
Galv. cor. shts. (")	22	12	6
Galv. flat shts. (")	23	2	6
Galv. fencing wire, 8g. plain	24	7	6

FINISHED IRON

	£	s.	d.
Crown iron:			
England and Wales ..	15	2	6
Scotland	15	2	6
Ireland, f.o.q.	15	15	0
No. 3 bars:			
England and Wales ..	12	5	0
Scotland	13	7	6
Ireland, f.o.q.	12	17	6
No. 4 bars:			
England and Wales ..	12	15	0
Scotland	13	12	6
Ireland, f.o.q.	13	7	6
Strip:			
England and Wales ..	16	10	0
Staffs marked bars, f.o.t...	18	0	0

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated, July 30, 1940.

	Dols.
No. 2 foundry, Phila.	24.84
No. 2 foundry, Valley	23.00
No. 2 foundry, Birm.	19.38
Basic, Valley	22.50
Malleable, Valley..	23.00
Grey forge, Valley	22.50
Ferro-mang., seaboard	120.00
O.-h. rails, h'y, at mill	40.00
Billets	34.00
Sheet bars	34.00
Wire rods	2.00
	Cents.
Iron bars, Chicago	2.25
Steel bars	2.15
Tank, plates	2.10
Beams, etc.	2.10
Skelp, grooved steel	1.90
Steel strip	2.10
Steel sheets	2.10
Sheets, galv., No. 24	3.50
Wire nails	2.55
Plain wire	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens)

Welsh foundry	42/6 to 44/-
" furnace	31/6 to 33/-
Durham foundry	39/6
" furnace	33/5
Scottish foundry	42/6 to 47/6
" furnace	31/6

TINPLATES

f.o.b. Bristol Channel ports

I.C. cokes	20 × 14 per box	..	28/-
"	28 × 20 "	..	56/-
"	20 × 10 "		39/6 to 40/6
"	18¾ × 14 "	..	29/-
C.W.	20 × 14 "	..	27/-
"	28 × 20 "	..	55/-
"	20 × 10 "	..	39/-
"	18¾ × 14 "	..	28/-

NON-FERROUS SCRAP

(Official Maximum Prices, per ton ex Works.)

	£	s.	d.
Bright untinned copper wire, in crucible form or in hanks	57	10	0
No. 1 copper wire	57	0	0
No. 2 copper wire	55	10	0
Copper firebox plates, cut up	57	10	0
Clear untinned copper, cut up	56	10	0
Braziery copper	53	10	0
Q.F. process and shell-case brass, 70/30 quality, free from primers	49	0	0
Clean fired 303 S.A. cartridge cases	47	0	0
70/30 turnings, clean and baled	43	0	0
Brass swarf, clean, free from iron and commercially dry	34	10	0
New brass rod ends, 60/40 quality	38	10	0
Hot stampings and fuse metal, 60/40 quality	38	10	0
Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin	72	0	0

NEW BRASS TUBES, etc.

	Per lb.
Solid drawn tubes	13½d.
Brazed tubes	15½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	8½d.
Sheets to 10 w.g.	10½d.
Wire	10½d.
Rolled metal	9½d.
Yellow metal rods	8½d.

COPPER TUBES, etc.

Solid drawn tubes	14½d.
Brazed tubes	14½d.
Wire	9½d.

PHOSPHOR BRONZE

	Per lb. basis
Strip	13½d.
Sheet to 10 w.g.	13½d.
Wire	15½d.
Rods	15½d.
Tubes	20½d.
Castings	17d.

Delivery 3 cwt. free.

10% phos. cop. £35 above B.S.
15% phos. cop. £40 above B.S.
Phosphor tin (5%) £40 above price of English ingots.

C. Clifford & Son, Limited.

AVERAGE MONTHLY PRICES OF UNMARKED BARS (SOUTH STAFFS)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1905	6 5 0	6 5 0	6 0 0	5 17 6	5 15 0	5 15 0	5 15 0	5 15 0	6 0 0	6 5 0	6 15 0	6 15 0	6 1 10
1906	7 0 0	7 5 0	7 5 0	6 17 6	6 15 0	6 12 6	6 10 0	6 10 0	6 12 6	6 16 3	7 3 9	6 17 8	
1907	7 3 9	7 5 0	7 5 0	7 5 0	7 5 0	7 7 6	7 5 0	7 7 6	7 7 6	7 7 6	7 7 6	7 5 0	7 5 11
1908	7 2 6	7 0 0	7 0 0	7 0 0	6 15 0	6 7 6	6 5 0	6 2 6	6 2 6	6 2 6	6 2 6	6 0 0	6 10 0½
1909	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 2 6	6 2 6	5 17 6	5 19 9
1910	6 2 6	6 3 4½	6 7 6	6 7 6	6 7 6	6 7 6	6 6 6	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 7
1911	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 10 0	6 12 6	6 16 6	6 7 8
1912	6 18 9	7 1 10	7 2 6	7 8 9	7 18 0	8 0 7	8 2 6	8 3 6	8 5 0	8 6 3	8 7 6	8 8 9	7 17 0
1913	8 11 6	8 10 7½	8 10 0	8 8 1½	8 2 0	8 0 0	7 17 6	7 11 6	7 8 9	7 5 6	6 18 1½	6 17 6	7 16 9
1914	6 17 6	6 15 7½	6 12 6	6 10 0	6 10 0	6 10 0	6 10 0	7 11 10½	8 0 0	7 12 6	7 5 7½	7 6 3	7 1 0
1915	7 11 6	8 5 11	8 8 9	9 6 0	10 3 2	10 19 2	11 12 6	11 13 1½	11 13 9	11 14 3	12 1 10½	13 0 9	10 6 0½
1916	13 7 6	13 10 8	13 12 9½	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	12 3 9
1917	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0½
1918	13 15 0	13 17 3	13 17 6	13 17 6	13 17 6	13 17 6	13 17 6	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 4 8
1919	15 10 0	16 5 0	17 15 0	17 15 0	20 15 0	21 0 0	21 0 0	22 0 0	22 0 0	22 0 0	22 7 6	22 12 6	20 1 8
1920	24 7 6	24 10 0	25 10 0	27 10 0	29 5 0	31 0 0	31 10 0	31 10 0	31 10 0	31 10 0	31 10 0	29 7 6	29 1 8
1921	26 17 3	25 0 0	23 0 0	21 0 0	19 0 0	18 5 0	16 0 0	16 0 0	15 14 0	14 0 0	13 6 8	13 0 0	19 4 5½
1922	13 0 0	12 3 9	11 14 0	11 11 10½	11 5 0	11 3 6	11 2 6	11 5 0	10 17 2½	10 16 3	10 13 0	10 12 6	11 7 0½
1923	10 16 10½	11 3 1½	12 2 6	12 8 9	12 11 6	12 1 3	11 15 11½	11 15 0	11 15 0	11 15 0	12 13 6	12 8 3	11 18 10½
1924	12 9 6	12 10 0	12 10 0	12 15 7½	12 17 6	12 17 6	12 17 6	12 17 6	12 17 6	12 14 0	12 12 6	12 12 6	12 14 2½
1925	12 12 6	12 12 6	12 12 6	12 12 6	12 12 6	12 7 6	12 7 6	12 7 6	12 4 6	11 18 6	11 13 9	11 13 0	12 6 2
1926	11 7 9½	11 5 0	11 5 0	11 5 0	11 3 9	11 3 9	11 5 0	12 0 0	13 0 0	*	15 7 6	12 10 0	12 0 2
1927	12 6 3	12 2 6	11 14 0	11 0 0	10 18 9	10 13 6	10 12 6	10 5 0	9 16 0	9 15 0	9 13 9	9 12 9	10 14 2
1928	9 12 6	9 12 6	9 11 0	9 10 0	9 8 4	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 3 6	9 1 3	9 7 0
1929	9 0 0	9 2 6	9 5 7½	9 9 4½	9 10 0	9 17 6	10 2 6	10 2 6	10 2 6	10 0 6	10 3 9	10 5 7	9 15 2½
1930	10 7 6	10 7 6	10 7 6	10 6 10½	10 6 3	10 5 0	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 4 7½
1931	10 2 6	10 0 0	10 0 0	10 0 0	9 18 1½	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 16 10½	9 18 0½
1932	9 15 0	9 16 0	9 15 0	9 15 0	9 13 9	9 11 3	9 10 0	9 10 0	9 10 0	9 6 3	9 5 0	9 5 0	9 10 11½
1933	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0
1934	9 5 2	9 8 1½	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 11 8
1935	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6
1936	9 12 6	9 15 0	10 2 6	10 2 6	10 2 6	10 2 6	10 6 3	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 5½
1937	10 10 0	10 10 0	11 17 6	11 17 6	11 17 6	11 17 6	12 4 6	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	12 4 11½
1938	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	15 3 0	13 5 0	13 5 0	13 5 0	13 5 0
1939	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 15 0	12 15 0	12 6 8
1940	12 15 0	12 17 6	12 17 6	13 16 3	14 2 6	14 2 6	15 2 6	—	—	—	—	—	—

* No quotation available owing to strike.

WILLIAM JACKS & COMPANY LIMITED
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK
GUMPER

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY LIMITED

CENTRAL CHAMBERS,
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ZETLAND ROAD,
MIDDLESBROUGH.

Notice

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

MALLEABLE FOUNDRY MANAGER open for engagement now. Fully experienced in sole control of 150 staff. Hand and machine moulders, annealing, pattern and core shops, machine shops and assembly work. Estimating, costing and commercial side generally. Time study and modern production methods. Would also consider employment as consultant to firms commencing malleable production.—Apply, Box 426, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

ASSISTANT Foundry Manager required. Must have some engineering experience, as well as knowledge of metals.—Write, stating age and wages required, to JAMES & COMPANY (BIRMINGHAM), LIMITED, Manor Lane, Halesowen.

METALLURGICAL CHEMIST required on Government production, Midlands. State age, experience and salary required.—Box 434, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

EMPLOYMENT REGISTER.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

CHIEF METALLURGIST, B.Sc., seeks similar position, wide experience ferrous and non-ferrous, heat-treatment, electroplating; accustomed taking full technical control. Knowledge French and German. (388)

QUALIFIED Accountant, many years' managerial experience in complete control of a large Non-Ferrous Foundry, requires responsible commercial or professional position with real prospects. (389)

FOUNDRY MANAGER, specialist in High-Duty Cast Iron for small and medium Engineering Castings, accustomed to highly mechanised plant; also knowledge of modern core shop control, brass and light alloys, requires similar position. (390)

MANAGER or Assistant Foundry Manager desires re-engagement; Light Alloys to Air Ministry Specs.; Alloy Cast Iron; Grey Iron; green sand; dry sand. Jobbing and machine moulding; pattern shop. (391)

MACHINERY

WANTED, for immediate cash, a second-hand Coleman Core Blower, in good condition.—CHAMBERLIN & HILL, LIMITED, Walsall.

WANTED, 8/12-Ton Jolt Machine; Jackman type; 20 in. to 30 in. bore.—Full particulars to Box 430, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

CUPOLA.—Alldays No. 1 Dwarf Type, with direct-coupled motor driven fan, 400/440 volts; 2.5 h.p. motor, with starter, almost new.—GEO. HENDERSON, LIMITED, 18, Forth Street, Edinburgh.

MACHINERY—*Continued*

IDLE PLANT won't help the country!

For the successful prosecution of the war the need for Plant and Machinery is as urgent as the need for men. Have you any surplus plant which might be set to work in the national interests? *We will either purchase outright, or negotiate the sale for you on a commission basis*

GEORGE COHEN SONS & CO., LTD. (Est. in the year 1834)

Wood Lane, LONDON, W.12. SHEpherds Bush 2070.
Stanningley Works, Nr. LEEDS. Stanningley 71171.
And at Birmingham, Sheffield, Manchester, Bristol, etc., etc.

FOR SALE.—One Incandescent Gas Furnace, with four burners, size of Oven, 1 ft. by 1 ft. by 2 ft. deep. Pyrometer by Elliott Bros. & Company, Limited; nearly new; £55.—ERICSSON BROS., LIMITED, 154, West Street, Erith, Kent.

SAND MIXERS AND AERATORS.—The "Breakir" Centrifugal Machine is *THE* machine. Outputs 10 cwts. to 8 tons per hr.—W. BREALEY & CO. LTD., Station Works, Ecclesfield, Sheffield.

CUPOLAS

6 ft. dia., 10 tons per hr.
3 ft. 6 in. dia., 3 tons per hr.
2 ft. 6 in. dia., 15-cwt. per hr. Cupolette.

PNEUMATIC MOULDING MACHINES

Macdonald Jolter, table 72 in. by 54 in.
Tabor 16-in. Shockless, table 72 in. by 48 in.
Tabor Portable Shockless Rollover, table 40 in. by 30 in.
Tabor ditto, table 27 in. by 20 in.
Tabor 21 in. by 16 in. squeeze.
Zimmerman Type R.P.W. 2 Jolt Squeeze turnover, table 36 in. by 20 in.
Mumford Type (Jackman) Swing Headpress, 13 in. by 15 in. and 14 in. by 16 in.
Mumford Pneumatic Core Jolters having 15-in. by 20-in. and 12-in. by 12-in. tables.
Britannia No. 1 "Coventry" Pneumatic Turnover Jarr Ram, table 30 in. by 28 in.
Rotoil Oil Sand Mixer.
50 Air Compressors; 500 Electric Motors, Dynamos, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD, LANGLEY,
Nr. Birmingham.
'Phone: Broadwell 1359.

THOS. W. WARD, LTD.

Seventeen BABCOCK & WILCOX WATER-TUBE BOILERS; heating surfaces 4,410 to 5,540 sq. ft.; pressure 200 lbs. per sq. in.; with ECONOMISERS, MECHANICAL STOKERS.
COCHRAN BOILER, 7 ft. 6 in. by 3 ft. 3 in.; gas fired; w.p. 100 lbs.
COCHRAN BOILER, 8 ft. by 3 ft. 9 in. by 100 lbs. w.p.
Stocks good CAST-IRON FLOORPLATES; lying at Sheffield and elsewhere. Details upon application.

Write for "Albion" Catalogue

ALBION WORKS, SHEFFIELD
'Grams: "Forward." 'Phone: 26311 (15 lines).

MISCELLANEOUS

LANCASHIRE Foundry wants to buy second-hand Top Part Moulding Box, approx. 9' square × 8" deep. In good condition. Urgent.—Box 432, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MISCELLANEOUS—*Continued*

Stocks of

BLACKLEAD
PLUMBAGO
TERRA FLAKE

Please send for prices and samples.

VAUGHAN, JONES & CO.,
8, UNION STREET, LIVERPOOL, 3.

'Phone: 22877 SLOUGH

TWO NEW Core blowers for bombs.
TWO NEW Shotblasts for bombs or shells.
JOLT SQUEEZE "JACKMAN" MOULDING MACHINES, 14" x 16", as new. £90 each.
"NICHOLLS" Joltsqueeze 18" x 14". £90.
Morgan 250 lb. Tilting Furnace.
Monometer ½-ton Semi-rotary.
NEW PIT FURNACES 150 lbs. capacity, oil or coke fired. £35 each.
NEW SHOTBLAST CABINET PLANTS with motor driven Exhaust Fans, complete, all sizes. Prompt delivery.
PLAIN JOLT RAM, with table 54 ins. square, cyl. 12 ins. dia. £90.

ALEX. HAMMOND, *Foundry Machinery Merchants.*
14, AUSTRALIA ROAD, SLOUGH
BUY FROM ME AND SAVE MONEY.

MAGNETIC SEPARATORS

"RAPID-BIAFLUX" *Patent*
PULLEY & DRUMS
The Popular
"OVERBAND"
FOR FOUNDRY SANDS
LISTED IN 5 SIZES

LIFTING MAGNETS
FOR PIG IRON & SCRAP
CLUTCHES & CHUCKS
THE RAPID MAGNETTING MACHINE Co., Ltd., Magnet Works, Lombard St., Birmingham, 12
'Phone: Victoria 1137-8 'Grams: "Borings, Birmingham"